

**Contract  
For Services for  
Design of quad vertical Vibration system  
and magnesium expander**



**Contract No. : KARI-14-0106**

**Between  
Korea Aerospace Research Institute  
And  
“ABC” Company**

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#### *1. Statement of Work*

**Preamble**

This Contract made on September \_\_\_\_, 2014 and will be valid until March 31, 2015 by and between Korea Aerospace Research Institute, established under the law of the Republic of Korea with its principal office at 169-84 Gwahakro, Yuseong-Gu, Daejeon 305-806, Korea, hereinafter referred to as “KARI” and xxx established under the law of the xxx with its principal office at xxx, hereinafter referred to as “Contractor”.

**Witnesseth**

WHEREAS, KARI has a satellite assembly, integration and test center (hereinafter referred to as ‘AITC’) for the purpose of the effective development of domestic satellites and basic facilities and equipment for satellite assembly and test have been supplied, installed and used;

WHEREAS, KARI desires of improving the current vertical vibration system to quad vertical vibration system & magnesium expander;

WHEREAS, Contractor represents that it has direct knowledge and first-hand experience in design of quad vertical vibration system & magnesium expander;

WHEREAS, Contractor shall perform the design of quad vertical vibration system & magnesium expander and the technical supports at KARI site during the manufacturing the vibration shaker system;

Now, therefore, in consideration of the premises and the mutual agreements herein contained, KARI and Contractor have agreed as follows;

## Article 1. Definition

The terms defined in this Article shall have the same meaning described to them herein whenever they are used in this Contract, unless otherwise clearly indicated by the context.

- 1.1 **Contract** means this Contract for Engineering and Technical Support Services for the design of quad vertical vibration system & magnesium expander, including all schedules, exhibits and other attachments hereto, as may be amended from time to time.
- 1.2 **Contract Price** means the amount of Contract. If there is any change in Contract Price due to any reason, then the Contract Price means current total amount of Contract.
- 1.3 **Contractor** means (Contractor), as a party to the Contract, together with its legal representatives, successors, assigns and Subcontractors.
- 1.4 **Deliverable Data** means any design, engineering or technical data and documentation as listed in Appendix 1, "List of Deliverable Items" that Contractor shall deliver to KARI, including any related data and information thereof, in the course of the provision of the Services .
- 1.5 **Deliverable Items** means any material, equipment or items as listed in Appendix 1 "List of Deliverable Items" that Contractor shall deliver to KARI, including any related data, information and manuals, in the course of the provision of the Services.
- 1.6 **EDC or Effective Date of the Contract** means the date identified in Article 20, 'Effective Date of Contract'
- 1.7 **Final Acceptance** means final acceptance by KARI of each Deliverable Items or Data in accordance with Article 11 'Inspection and Acceptance'.
- 1.8 **KARI** means Korea Aerospace Research Institute as a party to the Contract, together with its legal representatives, successors, assigns and Subcontractors.
- 1.9 **Milestone** means a portion of the definite, measurable work effort to be performed by Contractor, upon completion of which a payment is to be made in accordance with the payment schedule as set forth in Article 6 'Terms of Payment' herein.
- 1.10 **Party or Parties** means KARI or Contractor, or both, according to the context.
- 1.11 **Services** means any technical support and engineering services, including review, analysis, calculation and any other consulting and advisory services to be provided by Contractor under this Contract.
- 1.12 **Subcontract** means any subcontract, including purchase orders and all similar forms of agreements at any tier under this Contract.
- 1.13 **Subcontractor** means a contractor under any Subcontract, including suppliers.
- 1.14 **Third Party(ies)** means any individual or legal entity other than the Associates and the Parties

## Article 2. Objective

The objective of this Contract is to carry out and provide design of quad vertical vibration system & magnesium expander and perform the technical supports under the Contractor's responsibility. To accomplish this objective, Contractor shall perform all the works under this Contract required for SOW as well as Contractor's proposal.

## Article 3. Contract Documents

- 3.1 The Contract shall comprise the following documents, as amended from time to time by written agreement by and between both Parties.
- [-] Terms and Conditions (this document)
  - [A] Appendix
    - 1. Statement of Work
- 3.2 In the event of any inconsistency or discrepancy between or among the Contract documents as listed in Article 3.1 above, the Contract documents shall be applied in the decreasing order of precedence.
- 3.3 In the event of any dispute or difference between the Parties in the interpretation of this Contract as a result of the application of the Appendix as specified in Article 3.1, Contractor's Proposal dated \_\_\_\_\_, 2014 submitted to KARI in anticipation of this Contract in response to KARI's Request for Proposal dated \_\_\_\_\_, 2014 shall be used as a reference document to identify and clarify the intention and understanding of the Parties as contemplated in this Contract, and both Parties shall in good faith seek an agreement or a compromise acceptable to both Parties without modifications to this Contract.

## Article 4. Scope of Services

- 4.1 Contractor shall perform and accomplish the Services and any other scopes of works as required and to be added by KARI's requests under this Contract in a timely manner.
- 4.2 Contractor shall provide as sufficient as engineering and administrative manpower and resources for the timely completion of the Services under this Contract. In the event the Services are not completed with manpower and resources due to Contractor's fault, Contractor shall provide any additional manpower and resources to accomplish the Services free of charge to KARI.
- 4.3 Contractor shall provide any technical data or technical information as may be needed for KARI to understand the results of Services free of charge to KARI.
- 4.4 To accomplish this Contract, KARI shall cooperate to Contractor in order for it to obtain any necessary government and KARI's Associates approvals, if necessary. And Contractor shall obtain any government approvals required to accomplish and perform this Contract free of charge to KARI

## Article 5. Contract Price

- 5.1 For the full, satisfactory and timely performance of all obligations by Contractor in accordance with the provisions of this Contract, KARI shall pay to Contractor the Contract Price of **USD or EUR XXX.00** in accordance with the terms of payment as specified in Article 6, 'Terms of Payment'.
- 5.2 The Contract Price is a firm and fixed amount not subject to any escalation or to any adjustment or revision for any reason whatsoever, including but not limited to the increase of actual cost incurred by Contractor in the performance of the Contract.
- 5.3 The Contract price excludes any VAT that may be applicable in Korea.
- 5.4 All banking charges incurred in Korea shall be borne by KARI, and those charges incurred outside Korea shall be borne by Contractor.

## Article 6. Terms of Payment

- 6.1 The payment of Contract amount specified in Article 5.1 shall be made as per the following payment schedule, unless otherwise agreed upon by the Parties;
- a. First payment (USD or EUR XXX, 10%) shall be made after receiving a performance bond.
  - b. Second payment (USD or EUR XXX, 40%) shall be made after overall design (including FEM model) & expander drawings delivery.
  - c. Third and Final payment (USD or EUR XXX, 50%) shall be made after detailed drawing for sub components & Procedure delivery.
- 6.2 All payments shall be made in USD or EUR by wire transfer to the bank account as designated by Contractor in its invoice, within thirty (30) days after KARI's receipt of the Contractor's respective invoice.
- 6.3 Whenever the payment due date falls on Saturday, Sunday, KARI's non-business day or a Korean legal holiday, the payment date shall be the following business day.
- 6.4 Notwithstanding any provisions of this Contract, if Contractor has not accomplished its Task or other scopes of work under this Contract for any reasons attributable to Contractor, KARI may suspend the payment until Contractor proves that the work in question has been accomplished.

## Article 7. Taxes and Duties

- 7.1 If Korean income tax is required to be withheld from amounts paid or payable to Contractor under this Contract (herein referred to as 'Applicable Tax'), KARI shall withhold the Applicable Tax and pay on behalf of Contractor the relevant Korean taxing authority in accordance with applicable Korean law.
- 7.2 KARI shall forward proof of the withheld Applicable Tax to the Contractor within 90 days of payment.
- 7.3 Neither Party shall be responsible for paying the customs duties, and related taxes, fees or charges for the personnel and the personal belongings of the other Party.
- 7.4 Each Party shall further comply with instructions the other Party may issue from time to time in order to facilitate any exemptions or reductions from customs duties and other taxes that might be levied on the other Party.

## Article 8. Performance Bond

- 8.1 Contractor shall establish a performance bond within four (4) weeks after EDC in favor of KARI in the value of ten percent (10 %) of the Contract Price, in the form of an irrevocable and unconditional standby letter of credit available by KARI's draft at sight.
- 8.2 The entire amount covered by the performance bond shall be unconditionally payable to KARI on demand together with KARI's written statement to the effect:
  - (a) that there was a breach of the Contractor in the performance of the Contract (including the breach of its Subcontractor under the Subcontract); or
  - (b) that this Contract was terminated by Contractor's breach as specified in Article 14 'Termination'.
- 8.3 The letter of credit shall be issued by first class international bank acceptable to KARI. The letter of credit shall be drawn in favor of KARI and advised through the Woori Bank (Daejeon Branch at 1495 Dunsan-dong, Seogu, Daejeon, 302-173 Korea, Tel: +82-42-488-9704, Ext. 312, email: the\_banker@wooribank.com) and shall remain valid through the end of this Contract. The letter of credit shall not be amended, modified or canceled without KARI's prior written consent.
- 8.4 It is hereby agreed between the Parties that payment from the performance bond under this Article 8 shall not affect any other of KARI's rights, privileges, interests or remedies under this Contract.

## Article 9. Delivery

- 9.1 The Contractor shall deliver Deliverable Items or Data in accordance with the defined schedule and method as set forth in Appendix1 'Statement of Works'.
- 9.2 The Contractor shall deliver any Deliverable Items or Data under the rule of DAP KARI (Delivered At Place in accordance with the Incoterms 2010) in accordance with the delivery schedule of this Contract.

## Article 10. Delays in Performance

### 10.1 Excusable Delay

- (a) Neither Party shall be responsible to the other Party for any delay in performing its obligations under this Contract due to any events of Force Majeure.
- (b) 'Force Majeure' means any act of God, war, act or failure to act of any government in its sovereign capacity, fire, flood, earthquake, strike, epidemic, quarantine, embargo, nuclear incident, or any other act unforeseeable and beyond the reasonable control without the fault of either Party or its Sub-Contractors.
- (c) The Party whose performance of obligations hereunder has been affected by any events of Force Majeure shall notify the other Party within ten (10) days thereafter by sending a detailed statement and sufficient evidence with respect thereto, and promptly of any subsequent change in the circumstances, if any. The affected Party shall exercise its best efforts under the circumstances to remove or remedy the events of Force Majeure and the effects thereof and resume full performance hereof as soon as possible.

### 10.2 Non-Excusable Delay

- (a) In the event that, unless otherwise excused by virtue of this Contract or the governing or Applicable law, Contractor delays the provision of Services or delivery of any Deliverable Items or Data as stipulated in this Contract, or performance of its other obligations under this Contract, Contractor shall be responsible for damages incurred by KARI as a result of such delay.
- (b) Non-Excusable Delay, Liquidated damages, shall be applied for late performance or non-performance at the rate of zero point twenty-five (0.25) percent of total Contract price per calendar day, up to ten (10) percent of total price.

## Article 11. Inspection and Acceptance

### 11.1 The Final Acceptance of Deliverable Items or Data shall occur only after:

- (a) Deliverable Items or Data to be performed by the Contractor under the Contract for each Deliverable Item have been completed in accordance with the Contract; and
- (b) the Contractor has demonstrated to KARI that the Deliverable Items or Data meet the specifications and requirements in this Contract; and
- (c) all Works and conditions under the Contract to be fulfilled by the Contractor prior to the Final Acceptance have been met, in which case KARI shall finally accept, in writing, the Deliverable Items or Data subject to the provisions set forth below.

### 11.2 Subject to the conditions as set forth in Article 11.1 above, a Final Acceptance of Deliverable Items or Data shall be deemed to have occurred only when the Inspection and Acceptance of Deliverable Items or Data have successfully completed at KARI site and KARI's authorized representative has accepted Deliverable Items or Data in writing. If KARI determines that any Deliverable Item or Data is unacceptable, it shall justify such refusal to the Contractor, in writing. If such written Final Acceptance letter is not given to Contractor, within fifteen (15) days after the completion of the Inspection and Acceptance regarding the Deliverable Items or Data or if such Deliverable Items or Data are taken into use, such Deliverable Items or Data shall be deemed to have been accepted by KARI.

### 11.3 If any Deliverable Item or Data is determined to be unacceptable, it shall be considered as non-delivery and the Contractor shall, at its expense, promptly repair or replace such Items so that it

shall comply with the Contract specifications and requirements, and shall submit such repaired or replaced Items for its confirmation. The repaired or replaced Items shall be accepted in accordance with the requirements of Article 11.1.

- 11.4 The Parties agree that the acceptance of any Items under this Article shall not be interpreted or construed to mean that such Items are free of all defects and conform in all respects with the requirements of this Contract, and Contractor shall not be entitled to any additional costs incurred or to recover any damages suffered due to defects in the Items or KARI's rejection of the Items.

## **Article 12. Intellectual Property**

- 12.1 KARI shall own and have a right to use, without any obligation, all the Deliverable Items or Data provided by Contractor in its performing this Contract. Contractor shall take all necessary precautions so that the Services supplied hereunder shall be free from infringement of any patent, design patent, trademark, utility model or any other industrial property right, copyright, license or any other right thereunder of any third party or parties.
- 12.2 In the event that any party other than Contractor claims or threatens to claim infringement by KARI with respect to such use of the Deliverable Items or Data, Contractor shall defend, hold harmless, and indemnify KARI from such infringement claims.
- 12.3 This Article will survive the completion of the Contract, any termination, cancellation or expiration of the Contract in any manner whatsoever.

## **Article 13. Confidentiality**

- 13.1 Each party shall confidentially treat all documents, data, materials and information supplied by one to the other, and shall not disclose the above to any third party, and shall not use the above for any other purpose than for the performance of this Contract without prior written consent from the other party. However this Confidentiality obligation shall not be apply to the information which is made available to the general public.
- 13.2 If specified by written consent, both parties agree to enter into Non-Disclosure Agreement.

## **Article 14. Termination**

- 14.1 KARI may terminate this Contract upon written notice to Contractor;
- (a) if Contractor commits a material breach of any of its obligations under this Contract which shall not be remedied within thirty (30) days from the giving of written notice requiring such breach to be remedied; or
  - (b) Contractor fails to obtain the export or re-export license from any government other than Korean government or conditionally obtains in accordance with Article 16.4; or
  - (c) if Contractor or its creditors or any other eligible party shall file for its liquidation, bankruptcy, receivership, reorganization, dissolution or similar proceedings, or if Contractor's creditors have taken over its management.

- 14.2 In the event of such termination, Contractor shall return to KARI all materials, Data and documentation provided by KARI, at no cost to KARI, and KARI may perform the Services to completion. In addition, KARI, at its sole discretion, may;
- (a) either retain the Services which have already been or are supposed to be provided by Contractor up to the date of such termination by paying the payments which have already become due up to the date of such termination. Any and all terms and conditions of this Contract shall apply to such Services as if it had not been terminated; or
  - (b) Contractor shall return to KARI all the amounts received from KARI up to the date of such termination, and KARI shall return all Services provided by Contractor under this Contractor up to the date of such termination, in the manner of “as is”.

## Article 15. Warranty

- 15.1 All items and Services provided or delivered by Contractor to KARI or any person designated by KARI shall be sufficient, correct, and complete to enable KARI or its Subcontractors to perform their work for this contract. Contractor hereby warrants the Services against deviation from the Contract Specifications and against defects in workmanship, material and design when the Services are used under normal operation and proper maintenance conditions.
- 15.2 Warranty Period hereof shall be valid until acceptance test after designed shaker system installation from the date of Final Acceptance provided for in the Article 11 ‘Inspection and Acceptance’
- 15.3 In the event that Contractor does not commence immediately the rectification on such proven or admitted defects after receipt of notice from KARI, or does not complete the said rectification with reasonable diligence, KARI may, at its option, correct the defects at Contractor's expense. In the latter case, Contractor shall reimburse KARI for all costs incurred in connection with KARI's rectification of the defects and/or deficiencies within thirty (30) days after receipt of KARI's written invoice setting forth such costs.
- 15.4 Notwithstanding anything contained herein elsewhere, Contractor shall indemnify, defend and hold harmless KARI, its officers, directors, agents and employees from and against any and all property and/or personnel losses, injuries, deaths and/or damage arising from the defective part or parts of equipment.

## Article 16. Licenses, Clearances and Permits

- 16.1 Unless otherwise specified in this Contract, each Party is responsible for obtaining all government approvals from any government authority which has jurisdiction and authority to require such approvals, including, but not limited to, licenses, visas, and permits necessary to carry out such Party's obligations in accordance with this Contract. KARI is responsible for obtaining any necessary Korean government approvals, and Contractor is responsible for all other government approvals.
- 16.2 The Parties shall cooperate and provide each other, upon request of and without cost to the other Party, all reasonable and necessary assistance in obtaining any and all governmental approvals, which they respectively are required to obtain pursuant to this Contract. KARI shall provide the end use(r) statement (or certificate) in response to Contractor's request, if any.
- 16.3 Each Party shall be solely responsible for any expenses incurred in obtaining the approvals, which are required under this Article. The Parties shall provide to each other, upon request of and without cost to the other Party, suitable documents or other reasonable evidence to show that they have obtained any

and all governmental approvals, which they respectively are required to obtain pursuant to this Contract.

- 16.4 Contractor shall obtain the export license for the export of all Deliverable Items or Data to Korea, from Contractor's government and all other governments other than Korean government. In the event that Contractor fails to obtain the above export licenses, within six (6) months from the EDC, KARI has the right to terminate this Contract in accordance with Article 14.1.

## **Article 17. Resolution of Disputes and Governing Law**

- 17.1 In case any controversy or claim arises out of or in relation to this Contract or with respect to a breach hereof, the Parties shall seek to resolve the matter amicably through discussions between themselves. In the event of any disagreement between KARI and Contractor about the interpretation of the provisions or definitions used in this Contract, the interpretation of KARI shall govern until and unless otherwise decided by arbitration conducted pursuant to the following provisions.
- 17.2 If the Parties cannot resolve such controversy or claim in accordance with Article 17.1 above, it shall be finally settled by arbitration under the rules of arbitration of the Korean Commercial Arbitration Board in Seoul, Korea. The proceedings shall be conducted in English. The award rendered by the board shall be final and binding on the Parties and may be entered in any court of competent jurisdiction for execution.
- 17.4 The validity, performance, construction, and effect of this Contract shall be governed by the laws of the Republic of Korea.

## **Article 18. Indemnity**

Neither Party shall be liable to the other under this Contract or at law for any indirect or consequential damages including but not limited loss or profits, loss of use or loss of revenue. Any liability to either Party under this Contract shall be limited to the Contract Price.

## **Article 19. Language and Units**

- 19.1 All documents, drawings, plans and other writings as well as communications between both Parties shall be in English.
- 19.2 Measurements and quantities for deliverable documentation shall be recorded in units of metric system.

## **Article 20. Effective Date of Contract**

- 20.1 The effective date of this Contract ("EDC") is the date on which the duly authorized representatives of the Parties have agreed this Contract;
- 20.2 Any amendment to this Contract shall be effective upon signature by the duly authorized representatives of both Parties

## Article 21. Notice

Any and all notice to be given to either party shall be given to the following addresses by registered airmail or other telecommunication media. Either party may change its address by giving prior notice to the other party in the manner provided for herein.

For KARI: **Korea Aerospace Research Institute**

169-84 Gwahakro, Yuseong-gu, Daejeon 305-806, Korea

Commercial matters

**Mr. Jung-Nam Cho**

Tel: +82-42-860-2613

Fax: +82-42-860-2666

E-mail: jncho@kari.re.kr

Technical matters

**Mr. Jong-Min Im**

Tel: +82-42-860-2562

Fax: +82-42-860-2234

E-mail: acoust@kari.re.kr

For Contractor: xxx Company

Address

Commercial matters

**Mr.**

Tel: +

E-mail:

Technical matters

**Mr.**

Tel: +

E-mail:

## Article 22. Miscellaneous

### 22.1 Assignability

Except for the purposes of corporate merger, reorganization or reconstitution of a Contractor, this Contract and each and every covenant, term and condition hereof shall be binding upon and inure to the benefit of the Parties and their respective successors, and neither this Contract nor any rights and obligations hereunder shall be assignable or delegable directly or indirectly by any Party without the prior written consent of the other Party, which consent shall not be unreasonably withheld.

### 22.2 Entire Agreement

The Contract embodies the entire agreements of the Parties with respect to the subject matter hereof and supersedes and cancels any and all prior understandings or agreements, oral or written, in relation hereto, which may exist between the Parties. No oral explanation or oral information by any of the Parties shall alter the meaning or interpretation of the Contract.

### 22.3 Unenforceable Terms

If any term or provision of this Contract shall for any reason be invalid, illegal or unenforceable in any respect, the Contract shall be interpreted and construed as if such term or provision had never been included herein.

- 22.4 **Non-waiver**  
The failure or delay of any Party to require performance by the other Party of any provision of, or of any right or obligation under this Contract, shall not constitute a waiver thereof, nor shall such affect that Party's right to thereafter require performance of such or any other provision, right or obligation.
- 22.5 **Disclaimer of Agency**  
This Contract or performance under this Contract shall not be interpreted or deemed to constitute any Party the agent of the other Party. Neither Party shall have the authority to commit the other Party or its Subcontractors in any manner or to incur any obligation on behalf of or in the name of the other Party or its Subcontractors.
- 22.6 **Headings**  
The headings and title in this Contract have been inserted for convenience of reference only and are not to be used in consulting or interpreting the Contract.
- 22.7 **Time Limits**  
Unless otherwise indicated, any time limits to which the Contract binds the Contractor or KARI shall be counted in calendar days from the day following that of the event marking the start of the time limit, and shall end on the last day of the period specified. When the last day of a time limit is a Saturday or Sunday, or a legal holiday in the country in which the particular contractual performance is required, such time limit shall be extended to the first working day following.
- 22.8 **Subcontractors**  
Each Party shall be fully responsible for the work of its Subcontractors under the Contract, and such subcontracting shall not relieve that Party of its obligation under this Contract.

IN WITNESS WHEREOF, the Parties hereto have executed this Contract in duplicate in English by causing these presents to be signed by their duly authorized representatives as of the day and year first above written.

**Signed for and on behalf of KARI**

**Signed for and on behalf of Contractor**

**By:**

**By:**

**Name: Dr. Seung-Jo Kim**

**Name:**

**Title: President**

**Title:**

**Appendix**

**1. *Statement of Work***

## Appendix 1. Statement of Work Scope

### 1.1. General

As a Korean government-funded research institute, Korea Aerospace Research Institute (KARI) has undertaken the implementation of the GEO-KOMPSAT-2 (Geostationary Earth Orbit - Korea Multi-Purpose Satellite-2).

To increase the vibration shaker capability and improve the accessibility to satellite for the safe environmental testing, new guided expander system with quad shakers will be designed and built.

For these reasons, KARI would like to have your technical engineering and support on design of vibration shaker system

### 1.2. Technical Design Requirement

To increase the shaker capability and improve the accessibility to test object, new guided expander system with quad shakers shall be designed. The head expander should be designed with magnesium material for reducing the weight. Seismic mass should be designed to support dynamic load during the vibration test and also supply the rigid support and load path for the hydraulic bearings (Pad bearings of TEAM corp.). Quad shakers should be used to increase the capability. Top level of H/E is designed to same level of facility floor.

Quad vibration system shall be designed base on the concept design supplied in this document. If the supplier give the technical verifications and experiences for modification from the concept design, modified design can be suggested.

#### 1.2.1 Limitations for design the new vertical shaker system

- A. Use of existing shaker system (LDS V984) and Phase Control System
- B. Use of existing hydraulic bearing (16 Team 410-XAP pad bearings) or Can Use of hydraulic bearing (16 Team 412-XAP pad bearings)

#### 1.2.2 Design Requirements for the overall system

- A. Head expander dimension: 3.25 m x 3.25 m (can have chopped angles)
- B. Head expander material : Magnesium
- C. Mass of the expander: less than 2600kg
- D. Frequency of the vertical mode of the system: higher than 170Hz  
at bare table condition
- E. Maximum overturning moment: 200kNm with the use of 16 Team  
410-XAP pad bearings
- F. Frequency of the suspension of the reaction mass:  $\approx$  3Hz
- G. Reaction mass accommodate the pad-bearings

- H. Maximum displacement of shaker system: +/- 25mm
- I. Vibration excitation range: sine 5 Hz ~ 2,000Hz, Random 10Hz ~ 2,000Hz
- J. Vibration system rocking mode  $\geq$  50Hz
- K. Crosstalk at any position on bare table condition : 5 ~ 150Hz  $\leq$ 10%, 150 ~ 400Hz  $\leq$ 100%
- L. Homogeneity at any position on bare table condition : up to 100Hz  $\leq$ 15%
- M. H/E and shaker interface (coupling element) design < 280kg (4x 70kg)
- N. Maximum payload mass: 10 tons

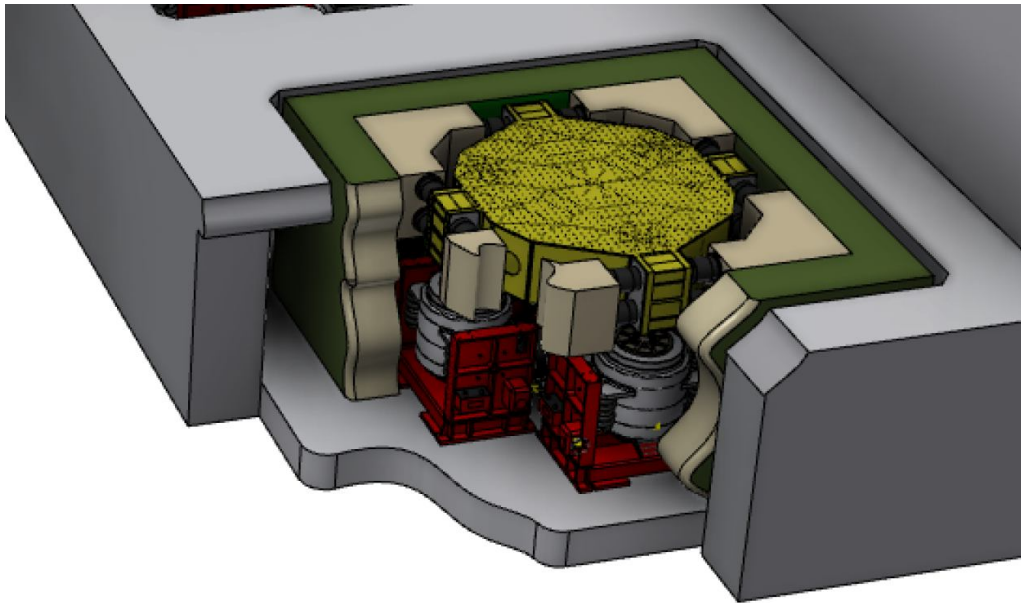


Figure 1.1 Concept design for quad shaker system

## 1.3. Subject & Deliverable Items

### 1.3.1 Overall design

- A. Overall drawings showing the architecture of the vibration shaker system
- B. System Design report to show the satisfaction of the design requirements
- C. Finite Element Model (FE Model shall include HE, Reaction Mass, Drive Bars, Pad Bearings according to the information provided by KARI. Shaker and Control system are not included in the FEM)
- D. Specification of the components (i.e. subsystems) of the system

### 1.3.2 Head expander

- A. Design report with qualitative predictions
- B. Overall drawing & Detail drawings for fabrication
- C. Guidelines for going from aluminum welded expander to magnesium welded expander
- D. Expander LOMC(List of manufacturing and control tasks) and guidelines for magnesium
- E. Technical Training for Magnesium welding in KOREA (5 days work)

### 1.3.3 Coupling Interface between H/E & Shaker

- A. Interface to minimize the horizontal reaction forces that built up at the interface with armature of shaker Provide a high axial stiffness(1800Hz) whereas much lower lateral stiffness
- B. Overall drawings & Detailed drawings of the drive bars for manufacturing in KOREA

### 1.3.4 Resting pads

- A. Overall design including a functional specification of the resting pads, the reference of the pneumatic actuator and the mechanical detailed drawings

### 1.3.5 Hydraulic bearings and installation and alignment devices

- A. Detailed drawings for fabrication of installation and alignment devices
- B. Interface drawing of the bearings and of the installation and alignment devices

- C. Instructions for the alignment of the bearings

### **1.3.6 Load support system**

- A. Overall design Including the specification of the static compensation system (mass to be carried, stroke) and the process flow diagram
- B. Detailed mechanical drawings and the reference of the air cushion.

### **1.3.7 Reaction mass**

- A. Overall design shall include the specification of the reaction mass and the reaction loads under the spring units. Reaction mass shall be designed to accommodate the pad-bearing for easy maintenance. The number and position of the spring units and visco dampers shall be defined in the overall design deliverable. Deliver a specification for the spring units and visco damper
- B. Execution drawings of the civil part of reaction mass
- C. Detailed drawings of the mechanical parts of the reaction mass. It shall also include the specification and mechanical drawings of the device between expander in test and reaction mass in order to maintain the cleanliness of the test room.
- D. Reaction mass fabrication procedure
- E. Seismic dimension are designed less than 7.4m(L) x 7.54(D)\*4.1m(H) including Spring and damper elements
- F. No oil-leakage from pad-bearing system & protective cover for pad-bearing system

### **1.3.8 Control panel/electrical cabinet**

- A. Overall design including comment on the logical diagram of the vibration system (shakers, amplifiers and shaker control excluded) prepared by KARI according to the maximum reuse of existing parts.

### **1.3.9 Technical Support at KARI**

- A. For inspection of H/E after manufacturing process
- B. Seismic concrete pouring stage [Check the status of mechanical structure]
- C. Alignment of bearing interface during seismic mass fabrication
- D. H/E, shaker & bearing alignment period
- E. Shaker performance testing after installation of all components
- F. 5 visits(5 working day basis)

**The delivered documentation shall be in English language and International System of Units shall be used.**

### List of deliverable items

Items	Deliverable items
Overall design	<ul style="list-style-type: none"> <li>-Overall drawings</li> <li>-Design report</li> <li>- FEM model(including HE, Reaction Mass, Coupling interface, pad bearing)</li> <li>Documentation for subsystem specification</li> </ul>
Head expander	<ul style="list-style-type: none"> <li>-Design report with qualitative predictions</li> <li>-Overall drawing &amp; Detail drawings for fabrication</li> <li>-Guidelines documentation</li> <li>-Expander LOMC(List of manufacturing and control tasks) and guidelines</li> </ul>
Coupling Interface between H/E & Shaker	-Overall drawings & Detailed drawings of the drive bars for manufacturing
Resting pads	-Detailed drawings
Hydraulic bearings and installation and alignment devices	<ul style="list-style-type: none"> <li>-Detailed drawings for fabrication</li> <li>- Interface drawing</li> <li>-Instructions for the alignment of the bearings</li> </ul>
Load support system	-Detailed mechanical drawings
Reaction mass	<ul style="list-style-type: none"> <li>-Execution drawings of the civil part of reaction mas</li> <li>-Detailed drawings of the mechanical parts of the reaction mass</li> <li>-Reaction mass fabrication procedure</li> </ul>
Control panel/ electrical cabinet	-Overall design documentation
Technical Support During warranty period	<ul style="list-style-type: none"> <li>-For inspection of H/E after manufacturing process</li> <li>-Seismic concrete pouring stage [Check the status of mechanical structure]</li> <li>-Alignment of bearing interface during seismic mass fabrication</li> <li>-H/E, shaker &amp; bearing alignment period</li> <li>-Shaker performance testing after installation of all components</li> </ul>

## 1.4. Review and Key-points

Kick-off/PDR/CDR/MRR/TRR/FAR reviews shall be held.

Review	Purpose	Schedule
Kick-off	<ul style="list-style-type: none"> <li>-Review the requirements of the system</li> <li>-Understand and agree the design baselines</li> </ul>	EDC+1M
Preliminary Design Review	<ul style="list-style-type: none"> <li>- Verify the compatibility of the design definition and predicted performance with system requirements</li> <li>- Verify the coherency of the equipment specifications with the subsystem specification</li> <li>- Review preliminary FEM model &amp; analysis report</li> </ul>	EDC+2M
Critical Design Review	<ul style="list-style-type: none"> <li>- Examine the compliance of the system performance characteristics with the subsystem</li> <li>- Examine the consistency of the developed components and interfaces with the subsystem baseline design</li> <li>- Verify compatibility of subsystem interfaces both internally and externally</li> <li>- Examine the manufacturing drawing for subsystem</li> <li>- Review final FEM model &amp; analysis report</li> <li>- Verify compatibility of the detailed design and complete set of analyses with the requirements</li> </ul>	EDC+4M
Manufacturing Readiness Review	<ul style="list-style-type: none"> <li>- Examine the manufacturing drawing for subsystem</li> <li>- Perform the technical support as below               <ul style="list-style-type: none"> <li>A. For inspection of H/E after manufacturing process</li> <li>B. Seismic concrete pouring stage [Check the status of mechanical structure]</li> <li>C. Alignment of bearing interface during seismic mass fabrication</li> <li>D. H/E, shaker &amp; bearing alignment period</li> <li>E. Shaker performance testing after installation of all components</li> </ul> </li> </ul>	Manufacturing Period

Test Readiness Review	- Review test plans, sequences and procedures	2 weeks before test activity
FAR (Final Acceptance Review)	-Review test results (Checking key requirements' performance consistency) - Final acceptance of subsystem	1 week after the test ends

The reviews attendance, duration, and documentation may be optimized in view of the above defined goals, in order to avoid unnecessary duplications.

## 1.5 Management requirements

The Contractor shall implement and maintain a perfect management organization in order to manage and control adequately all the activities of the contract.

The Contractor shall nominate the key persons who perform the essential functions for the execution of tile contract. Any change of key personnel shall be reported to KARI beforehand.

KARI shall have access to the Contractor's facilities, to all equipment related documentation and to all areas where the project work is performed. The access shall also be granted for KARI. Electronic information exchange shall be implemented according to any of the following production standard:

- MS-Word, MS-PowerPoint, MS-Excel for Windows XP
- Portable Data Format document generated using Adobe Acrobat Software

Documentation transmission may use either Internet, e-mail or hard media (CD-ROM, diskettes). Existing documentation will be kept as is. In any case, formal paper copy shall be delivered.

KARI will exercise its control and monitoring of the Contractor through the progress reports, progress meetings or other meetings, and reviews as defined in this S.O.W. Conference calls can be organized whenever necessary or for efficiency reasons.

The Contractor shall provide a project directory enabling efficient communications and keep it up to date.

A project Management Plan shall be issued by the Contractor reflecting the management principles implemented in answer to the above requirements.

The Contractor shall provide to KARI, every month, a progress report providing concise description of:

- major achievements of the period (including formal milestones and deliveries)
- major achievements planned for next period
- area of concerns description (including PA issues) and recovery/risk mitigation actions
- major engineering data
- master schedule (as a minimum),
- action item list

## 1.6 Acceptance Test

The contractor should take part in the acceptance test to verify the satisfaction of design requirement with KARI.

If the design requirements is not satisfied from the results of acceptance test, the Contract should supply solution method to satisfy the design requirement.

#### **- Acceptance test for H/E**

After manufacturing the magnesium H/E, Contract and KARI perform the modal test for H/E on free-free boundary condition. Compare the measured resonance frequencies with analysis results.

#### **- Alignment measurement for Seismic mass and interface**

During the construction period, Measure the alignment between the seismic mass and pad-bearing interface and check the alignment requirement [which is supplied by TEAM cooperation]

#### **- Acceptance test for quad-shaker system**

After the installation of whole components, Contract and KARI perform the acceptance test to confirm the satisfaction of design requirements

## **1.7 Warranty**

Notwithstanding the prior inspection or acceptance by KARI, Contractor warrants that:

- Deliverable Item supplied by Contractor shall be in good working order and free from all defects in workmanship and shall comply with the requirements of this Contract. **The warranty for Deliverable Item shall continue until Acceptance test after designed shaker system installation.**
- During the manufacturing and installation period, the technical supports which are defined above should be supplied.
- All Items delivered by Contractor to KARI shall be sufficient, correct, and complete to enable KARI or its Subcontractors to perform their work.
- The Contractor shall, at its own expense, immediately correct any defect in the design or any defect in other Deliverable Item for the period agreed by both Parties, notwithstanding that a milestone payment may have been made in respect thereof. If the Contractor fails to remedy any or all such defects in the agreed timeframe, KARI shall have the right to have such defects remedied through other means, and the Contractor shall pay the costs thereof.
- The Contractor shall not be entitled to any additional costs incurred or to recover any damages suffered due to defect in the Deliverable Item or rejection of the Deliverable Item by KARI