Rhode Island Airport Corporation

April 18, 2016

ADDENDUM NO. 001
Invitation for Bid No. 26034 - EMAS
Runway 5 Extension – EMAS System
T. F. Green Airport
Warwick, Rhode Island

Prospective Bidders and all concerned are hereby notified of the following changes in the Invitation for Bids document for the bid of Runway 5 Extension – EMAS System at T. F. Green Airport, IFB No. 26034-EMAS. These changes shall be incorporated in and shall become an integral part of the contract documents.

Questions & Responses

1. The Buy American - Certificate form on 00320-24 appears to be outdated. The current form and requirements are in www.faa.gov/airports/aip/procurement/federal_contract_provisions/. Will RIAC be updating the bid documents to include the current form and required provisions?
   - ANSWER: Please use the updated certificate form in Section 00950.

2. If there is scope missing or scope changes from the specifications and drawings provided in the bid documents for either EMAS, that is then later defined on the signed and sealed drawings and specifications required to be submitted after the contract is awarded, will RIAC be responsible for additional costs via a change order to the contract?
   - ANSWER: The EMAS manufacturer is either the bidder or the bidder's supplier. The system was designed by the EMAS manufacturer. It is the Runway 5 Extension – EMAS System Contractor's responsibility to coordinate ALL costs prior to bidding unless the design parameters in technical specification SP-555 are changed.

3. SP-555-3.4, fourth bullet, states that "the use of the 0.25 breaking (sp) coefficient may be used for the entire length of the setback and within the EMAS material, in accordance with FAA Advisory Circular 150/5220-22B." This is not an accurate statement as the Advisory Circular does not detail how the braking coefficient is to be applied. The FAA has approved over 100 EMAS designs with the 0.25 braking coefficient applied only within the setback pavement. It should not be expected that the braking action of aircraft gear would be the same within an EMAS material as it is on pavement. Thus, an EMAS design that applies a 0.25 braking coefficient in both the setback pavement and through the arrestor

material would seem to overestimate predicted performance. Will RIAC review this item with the FAA and correct or clarify specification P-555 in the bid documents?

- ANSWER: The EMAS designs were reviewed and approved by the FAA using the same criteria. RIAC will review with the FAA after the bid.

4. Will the Runway 5 Extension Contractor be required to maintain the survey control points used to construct the pavement on which the EMAS is to be installed and provide information for those control points to the EMAS Vendor so that the EMAS can be installed utilizing the same control?
   - ANSWER: Layout for the EMAS System is in the EMAS System contract, which will be assigned to the Runway 5 Extension contractor.

5. Can portions of the EMAS that are best installed prior to paving the runway safety area be constructed in Phase 1 of the Runway 5 Extension?
   - ANSWER: Yes, but only limited work that makes sense for constructability may be granted if agreed by the Owner, Engineer and Runway 5 Extension Contractor, such as anchor beam and modifying the asphalt layers for certain EMAS systems.

6. Can the entire EMAS be installed during Phase 1 of the Runway 5 Extension if the EMAS is available and ready for installation? What is limiting the EMAS to being installed in Phase 2 as the documents show?
   - ANSWER: No.

7. If the EMAS Contract is being assigned to the Runway 5 Extension Contractor, will work in the EMAS Contract be applied to the 8.6% DBE goal of the Runway 5 Extension Contract?
   - ANSWER: The EMAS System procurement will have its own requirement for DBE Participation and the same 8.6% DBE goal. The EMAS System contractor will submit a DBE Plan to meet the contract requirements prior to signing a contract with RIAC. The accepted DBE Plan will then be assigned along with all other contract terms from the EMAS System contractor to the Runway 5 Contractor.

8. If the pavement in the runway safety area does not meet the minimum requirements for the EMAS installation in terms of correct grades, elevations, or smoothness, for example, caused by any settlement or other issues between the time the pavement was accepted for payment under the Runway 5 Extension Contract and the time the EMAS Contractor is ready to install the EMAS, will the Runway 5 Extension contractor that constructed the pavement be required to correct any deficiencies prior to the EMAS installation?
   - ANSWER: Yes.

9. In Item P-555, will the Final EMAS Design Report also be required to be signed and sealed by a licensed Rhode Island Professional Engineer?
   - ANSWER: Yes, and this will be required prior to award.

10. In Section 0800-Summary of Work, 8.2, and Section 01040-Project Coordination, 1.7, please provide additional detail of RIAC's expectations of the Runway 5 Extension Contractor in being assigned the EMAS Contract, such as purchasing the EMAS material and installation and processing invoices from the EMAS Vendor. Who will the EMAS Vendor be addressing its invoice to for material and installation of the EMAS?
    - ANSWER: The EMAS System Contractor will become a subcontractor to and send invoices to the Runway 5 Extension Contractor. Per the method of measurement and basis of payment for each EMAS supplier, the EMAS is not paid until it is installed and accepted.

11. If the EMAS Contract is assigned to the Runway 5 Extension Contractor, how will the EMAS manufacturer's inspectors maintain authority over the EMAS installation with respect to items such as scheduling of the installation, access to the site, site conditions, and weather concerns to be compliant with the EMAS specifications?
    - ANSWER: The contract terms require that the EMAS System supplier has a representative on-site at all times and will be required to certify that the installation of the EMAS with their plans and specifications and proprietary requirements which are necessary to meet FAA approval.

12. Item P-555 requires FAA approval of both the Preliminary and Final EMAS Design Reports prior to EMAS construction. When is FAA expected to issue its approval? Who is responsible for submitting documents to FAA for approval, and what documents need to be submitted? What happens if FAA does not approve the design report of the EMAS in the winning bid?
    - ANSWER: Approval will occur prior to the EMAS Construction. FAA has already issued approval for both systems reports. Unless there is a change in design, this should be of no concern. Documents shall be submitted following procedures in the Contract Documents.

13. Item P-555 lists Runway Safe as an EMAS supplier. It is known that the Runway Safe EMAS does not meet FAA AIP Buy American requirements. How is Runway Safe qualified to supply an EMAS for this project?
    - ANSWER: We anticipate that Runway Safe EMAS will have FAA AIP Buy American requirements satisfied by award.

14. If the winning bid includes an EMAS system that does not meet Buy American requirements, by when will that system need to meet Buy American requirements? If it does not meet the requirements in time, how will the award be given to the other EMAS system? Will FAA have funds available to cover any additional cost if there is a change in award for this reason?
    - ANSWER: The bids will need to meet Buy American requirements by award of the contract. If requirements are not met, the bid will be

considered non-responsive. Funds are available, but there is no anticipation to change the award.

15. When is the successful bidder expected to be under contract with RIAC? When is that contract expected to be assigned to the Runway 5 Extension Contractor?
    - ANSWER: This is not yet determined but will be after the contract has been assigned to the Runway 5 Contract. An award for the EMAS System is anticipated within 120 days after the EMAS System bids are received. The anticipated Notice to Proceed for EMAS installation is May 1, 2017.

16. If the Runway 5 Extension Contractor and EMAS Contractor are utilizing the same gates at the same time, who will be responsible for providing any required Gate Guards?
    - ANSWER: The Runway 5 Extension – EMAS System Contractor is required to supply a gate guard as needed for their operations.

17. 00100-8, number 1 requires evidence of contractor experience for a minimum of one installation of an FAA approved EMAS System. The two systems are not the same; does contractor experience on one system qualify as experience to install the other system?
    - ANSWER: As the both EMAS specifications require the EMAS manufacturer's representative to be on-site at all times during construction, any installation Contractor shall meet this requirement as the EMAS manufacturer is essentially the Contractor or at least a Subcontractor to the Contractor.

18. If the EMAS Contract is assigned to the Runway 5 Extension GC, how will the EMAS Contractor be guaranteed that the Runway 5 Extension GC will not delay the EMAS installation and put the EMAS Contractor in a position to be responsible for liquidated damages?
    - Per the plan sheet GC101, Sheet Notes, the EMAS is required to be completed by August 1, 2017. This requirement becomes a requirement to the Runway 5 Extension Contractor at the time the contract is assigned.

19. SP-555-3.3 only references Maximum Takeoff Weight. Is it also intended to require the EMAS to stop all fleet mix aircraft at 80% Maximum Landing Weight as is listed in SP-555-3.4?
    - ANSWER: Yes and both systems have been approved by the FAA with both the same maximum takeoff weight and the 80% Maximum landing weights.

20. SP-555-3.4 second bullet. Please confirm "80& Maximum Landing Weight" is a typo and should read "80% Maximum Landing Weight".
    - ANSWER: See revised Item SP-555.

21. In SP555-3.3 or -3.4, please also provide the exact Maximum Takeoff and 80% Maximum Landing Weights that are to be used in the EMAS design for each aircraft provided.
    - ANSWER: These were supplied to both EMAS manufacturers and part of their FAA approved EMAS systems and these FAA approved designs will not change.

22. Who will be responsible, on site, for receiving EMAS materials for delivery? Are there any restrictions on when the EMAS materials can be delivered?
    - ANSWER: The Runway 5 Extension – EMAS System Contractor is responsible for receiving EMAS materials. Timing shall be coordinated with the Runway 5 Extension contractor.

23. If the winning bidder submits identical prices for both alternates/EMAS systems, who and how will RIAC determine which bid price is selected?
    - ANSWER: This is a hypothetical question that cannot be answered at this time. RIAC will determine if this happens.

24. Can the winning bidder substitute a different EMAS system after the bid is awarded?
    - ANSWER: No, only one alternate will be awarded and that shall be the system installed.

25. In Section 80, 80-01 it says the contractor (GC) must perform with their organization an amount of work worth at least 25% of the total contract cost. Can FAA and RIAC provide some guidance as to who is allowed to act as prime contractor and submit a bid if the EMAS manufacturer's materials and on site supervision is worth greater than 75% of the total cost of the system installed?
    - ANSWER: This requirement shall be waived.

26. Under FAA Section 20, paragraph 20-02, would vendor registration on http://www.purchasing.or.gov/RIVIP qualify as prequalification with the State Highway Division and being on the current "bidder's list" of the State of Rhode Island? If not, what steps are required to prequalify with the Rhode Island DOT and get on the current Rhode Island state "bidder's list"?
    - ANSWER: EMAS System contractors do not need to be pre-qualified by the state highway division.

<u>Project and Technical Specifications:</u>

1. DELETE the following Contract Specifications in their entirety and SUBSTITUTE THEREFOR the following attached Contract Specifications:
    a. Item SP-555, EMAS Bed Requirements
        i. Modified the specification.
    b. Item SP-556 EMASMAX® Engineered Material Arresting System Modified the specification

i. Modified the specification.

c. Item SZ-100 Runway Safe Engineered Material Arresting System (EMAS)

i. Modified the specification.

Carla M. Ottaviano
Financial Analyst and Administrator

End of Addendum 001

Item SP-555 EMAS Bed Requirements

DESCRIPTION

555-1.1 This item shall consist of the EMAS Contractor's coordination with the Runway 5 Extension Contractor, as well as the performance requirements for the Engineered Material Arresting System (EMAS) in accordance with the FAA approved EMAS material manufacturer's specifications, manufacturer's requirements and manufacturer's drawings, for the Runway 23 Departure End (Runway 5 End) location and of the form and dimensions shown on the plans. The EMAS provider will be required to meet the Buy American requirements listed in Section 00950.

SPECIFICATIONS AND SUBMITTALS REQUIRED

555-2.1 Specifications. The EMAS materials shall be manufactured in compliance with FAA Advisory Circular 150/5220-22B. There are two FAA approved EMAS suppliers:

> **Alternate A: Zodiac Aerospace – ESCO** (contact Mr. Trip Thomas at 1-856-241-8620 x 459 or Trip.Thomas@zodiacaerospace.com) **– Drawings QS101, QS501-QS503 and specification SP-556**
>
> and
>
> **Alternate B: Runway Safe** (contact Mr. Marc Klein at 1-630-816-6495 or marc.klein@runwaysafe.com) **– Drawings QJ101, QJ500-QJ504 and specification SZ-100**

555-2.2 Submittals Required From Selected Manufacturer After Contract Award. The EMAS Contractor shall submit the following prior to contract award for approval by the FAA and Engineer:

> Preliminary and Final EMAS Design Reports signed and sealed by a licensed Rhode Island Professional Engineer for the awarded EMAS system
>
> Five (5) complete sets of installation drawings and construction specification signed and sealed by a licensed Rhode Island Professional Engineer for the awarded EMAS system provider and shall include:

- Complete set of Construction Drawings including at a minimum:
  - EMAS Plan View
  - EMAS Profile View
  - Detail Sheet (s)
    - Anchor Beam Detail(s) (if Required by EMAS Manufacturer)
    - Any Details Pertinent to Construction
- Complete specification for the Construction of the EMAS including at a minimum:
  - Construction Methods
    - Detailed Installation Methods
    - Receiving
      - Equipment Needed

- Layout Requirements
- Detailed Requirements for the Placement of EMAS Material
- Control of Debris

- Contractor Installation Labor Requirements for Each Phase of Construction
  - Type of Worker
    - Number of Worker Type Required
    - Number of Days Needed
    - Work Involved for Each
  - Type of Equipment
    - Number of pieces of Equipment Required
    - Number of Days Needed
  - Type of Materials Needed
    - Type of Material
    - Quantity of Material

- Construction Schedule

- Quality Control Measures to be Taken

The EMAS Contractor shall submit the following a minimum of six months prior to EMAS installation for review and approval by the Engineer:

Shop drawing submittals shall be made for all materials not supplied by the awarded EMAS system provider and in accordance with the previously mentioned manufacturer's specification.

555-2.3 Submittals Required After Contract Award. The Runway 5 Extension – EMAS System contractor shall submit the following after Contract Award:

The quote from their bonding company (for the performance bond – Section 00600, and the labor and material payment bond – Section 00610) showing the bonding costs broken down to include initial bonding costs, monthly bonding costs and any cancellation fees for the bonds.

After the Contract is assigned to the Runway 5 Extension Contractor, the performance bond and the labor and material payment bond shall be cancelled and the contract shall be reduced the amount shown on a paid cancellation invoice from the bonding company showing the initial bonding costs, monthly bonding costs and any cancellation fees for the bonds that have been paid by the Contractor.

GENERAL PROJECT INFORMATION AND EMAS PERFORMANCE REQUIREMENTS

555-3.1 Runway 5 Extension Project Description. The project generally includes extension of the Runway 5 from 7,166 feet to 8,700 feet (1,534 feet) and paved shoulders. The extension will require the installation of an EMAS system at the end of the extension to provide a standard RSA utilizing EMAS. This project was broken into two separate bids: the Runway 5 Extension and the Runway 5 Extension – EMAS system.

555-3.2 Existing Site and Proposed Site Design. The Manufacturer and EMAS Contractor shall see Sheet QS101 for the proposed EMAS layout, Sheet CG102 for the existing site and proposed site conditions, CG201 for the Runway 5-23 centerline profile of the Runway 5 Extension Project – RIAC Construction

Contract No. 26034. In addition the entire Contract Drawing set (Volume 1 and 2) for the Runway 5 Extension project at T.F. Green Airport provides detailed information regarding the EMAS construction work area and other work areas of the project. The drawing set for the Runway 5 Extension – EMAS System consists of the following sheets:

- GI001 – Cover Sheet
- GI002 – Quantities for Canvass of Bids and Sheet Index
- GI101 – General Plan
- GC101 – Construction Safety Phasing Plan

Zodiac Arresting America EMAS

- QS101 – EMASMAX Plan
- QS501 – EMASMAX Profile
- QS502 – EMASMAX Sections
- QS503 – EMASMAX Details

Runway Safe EMAS

- QJ101 – EMAS Plan
- QJ500 – Proposed Runway Layout
- QJ501 – Strut Channel Spacing Details Runway 5 EMAS
- QJ502 – Front, Side, and Back Ramp Details
- QJ503 – Strut Channel and CLSM Cover Details
- QJ504 – EMAS Bed Mill Details

555-3.3 Aircraft Fleet Mix for EMAS. The following list of aircraft shall be included in the **standard** EMAS design (stopping all fleet mix aircraft exiting the runway at 70 knots and at Maximum Take-Off Weight):

Boeing 737-300	Boeing 757-200	Boeing 767-300
Boeing 737-400	Boeing 737-500	Boeing 737-700
Boeing 737-800	Airbus 319	Airbus 320
MD81/82/83	CL600	CRJ900
ERJ145	Citation X	

555-3.4 EMAS Size and Performance Specifications. The EMAS material must start a minimum of 216 feet from the proposed runway end and may extend 455 feet (total of 671 feet from the proposed runway end) and a maximum width of 180' centered on the Runway centerline. The proposed EMAS shall be a standard 70 knot EMAS with the following requirements:

- Standard "Safe Stop" case where the entire aircraft exiting the runway at Maximum Take-Off Weight (MTOW) and at 70 knots is stopped entirely within the EMAS bed.
- Standard "Safe Stop" case where the entire aircraft exiting the runway at 80% Maximum Landing Weight (MLW) and at 70 knots is stopped entirely within the EMAS bed.
- No overloading of the aircraft's nose gear within this Standard "Safe Stop" condition.
- The use of the 0.25 breaking coefficient may be used for the entire length of the setback and within the EMAS material, in accordance with FAA Advisory Circular 150/5220-22B. If the EMAS manufacturer prefers to utilize the breaking coefficient within the setback only, this is acceptable however not required.

555-3.5 Anchor Beam Specification. The EMAS anchor beam, if required by the EMAS manufacturer, shall be as designed by the EMAS manufacturer and must start a minimum of 205 feet from the proposed runway end.

METHOD OF MEASUREMENT

555-5.1 There shall be no separate measurement for payment for the EMAS Contractor's coordination with the Runway 5 Extension Contractor and providing the require submittals from **Section P-555-2.2**. The EMAS Contractor's coordination with the Runway 5 Extension Contractor and providing the required submittals from **Section P-555-2.2** shall be considered a necessary and ancillary component of the Work..

BASIS OF PAYMENT

555-6.1 There shall be no separate payment for the EMAS Contractor's coordination with the Runway 5 Extension Contractor and providing the required submittals from **Section P-555-2.2**. The cost of the EMAS Contractor's coordination with the Runway 5 Extension Contractor and providing the require submittals from **Section P-555-2.2**, including all materials, equipment, labor, tools, and incidentals required to complete this item shall be included with the various pay items involved.

END OF ITEM SP-555

Item SP-556 EMASMAX® Engineered Material Arresting System

DESCRIPTION

556-1.1 This item shall consist of furnishing and installation of an EMASMAX® Engineered Material Arresting System (EMAS) manufactured and supplied by Zodiac Arresting Systems America and construction of associated concrete anchor beam on the Runway 23 Departure End (Runway 5 Approach End) of T.F. Green Airport in accordance with these specifications, manufacturer's requirements and the contract drawings, at the locations and to the form and dimensions shown on the plans. This item shall include all labor, local trucking delivery and installation materials for the EMAS, including but not limited to conventional forklifts. This item also specifically includes all EMAS BLOCKS, debris deflector with anchors, joint sealing filler, side coating and side vents, and weather-tight seals for approach lights supports within the EMASMAX system. This item does not include any pavement, delineators, pavement marking, or pavement grooving. All EMASMAX blocks, installation materials, and on-site installation supervision shall be supplied from Zodiac Arresting Systems America. Contact Mr. Trip Thomas at Zodiac Arresting Systems America at (856)241-8620x459 for price information.

MATERIALS

556-2.0 Specifications: The EMAS materials shall be manufactured in compliance with FAA Advisory Circular 150/5220-22B. Additionally, the following materials shall conform to the requirements of the following specifications:

Material	FAA Specification
Concrete Anchor Beam	P-610
Chevron Paint	P-620

556-2.1 Submittals. The EMAS Contractor shall submit the following shop drawings:

- Submittal Requirements of Specification SP-555.
- Concrete mix design, curing compound, and reinforcing steel conforming to FAA Specification P-610, Structural Portland Cement Concrete using 4,000 psi concrete mix

556-2.2 Concrete. All concrete for work under this section shall conform to FAA Specification P-610, Structural Portland Cement Concrete, and using 3/4-inch maximum size coarse aggregate.

556-2.3 EMASMAX System. The EMASMAX® Engineered Material Arresting System (EMAS) arrestor bed and associated installation materials shall only be furnished by Zodiac Arresting Systems America, and shall not be accepted until the following installation tolerances are met:

Dimension	Lower Tolerance	Upper Tolerance
Width of Bed	-0.1 %	0.1 %
Length of Bed	-0.1 %	0.1 %
Height of Bed	-.25 inch	+ 0.75 inch

CONSTRUCTION METHODS

556-3.1 Weather Limitations. The surface of the pavement must be dry and above 40 degrees F, and rising, before concrete anchor beam or EMASMAX block installation may begin. Surface temperatures for chevron marking of the EMAS shall be above 45 degrees F, and rising.

556-4 Installing Concrete Anchor Beam

556-4.1Layout. The EMAS Contractor shall layout the Concrete Anchor Beam in accordance with the Contract Documents showing the location and dimensions required.

556-4.2Installation. The EMAS Contractor is responsible for the complete installation of the anchor beam. This shall include removal of any pavement placed during the Runway 5 Extension project. The cost of removal of existing pavement, forming, and pouring the anchor beam including all labor, materials, equipment, tools and incidentals to complete the anchor beam in accordance with the EMAS manufacturer's drawings and this specification. The EMAS CONTRACTOR shall coordinate with the Runway 5 Extension Contractor so as to install the concrete anchor beam prior to paving of the Runway Safety Area.

556-4.3Quality Control. EMAS Contractor must place the Concrete Anchor Beam in accordance with the EMASMAX manufacturer's installation specifications, FAA Specification P-610, Structural Portland Cement Concrete, and a Quality Control Plan approved by the Engineer. The Concrete Anchor Beam shall be poured monolithically and its edges shall not have chamfers or radii. Placement tolerances are extremely important in installing the Concrete Anchor Beam to allow for proper EMASMAX arrestor bed installation as shown on the drawings and included in this specification. The back of the Concrete Anchor Beam (side facing the EMASMAX arrestor bed, shall be perpendicular with the runway centerline as measured from centerline to each end within +/- 1/4". The length of the anchor beam shall be 178.20' +3"/-0". The front edge of the top of the Concrete Anchor Beam shall match the elevation of the adjacent pavement toward the runway. The back edge of the top of the anchor beam shall be 3" +0"/-1/4" above the adjacent pavement onto which the EMASMAX blocks are to be placed. The EMASMAX manufacturer shall inspect the Concrete Anchor Beam to confirm proper placement prior to installation of the EMASMAX blocks.

556-5InstallingEngineered Material Arresting System (EMAS)

556-5.1WorkSummaryforPVDRunway23 Departure End (Runway5 End). The EMASMAX bed installation for the PVD Runway 23departure end involves the receiving and placing of 4,532pre-cast cellular concrete blocks into a bed with dimensions of approximately 178feet wide by 417 feet long (44 blocks wide x103 blocks long). The blocks are manufactured by Engineered Arresting Systems Corporation d/b/a Zodiac Arresting Systems America. The blocks are nominally 4-ft. wide x 4-ft. long x 6 7/8-inches up to 26 7/8inches in height. Approximately 3% more blocks than necessary will be shipped to adjust for blocks damaged during shipping and installation. Pallets, extra material, and extra block will be repackaged for transport back to Zodiac Arresting Systems America by the installing EMAS Contractor. EMASMAX blocks are shipped stacked on pallets. The largest pallet of stacked blocks is nominally 4-ft. x 4-ft. x 77-in. and weighs approximately 2,000 lbs. Receiving the 53' trailers containing the pallets of blocks will start one to two weeks prior to beginning the installation and will continue during block installation. Installation of the blocks can commence when approximately 20% of the EMAS

blocks have been received or the trailer storage area provided by the Airport has reached maximum capacity. It is estimated that delivery of the blocks and other related installation material requires about 70trailers.

Zodiac Arresting Systems America will have field representatives on-site during the installation of the EMASMAX system to train the EMAS CONTRACTOR's personnel on the proper handling of the EMASMAX blocks and installation technique. In addition, the Zodiac Arresting Systems America field representative will monitor the installation progress and quality of the work throughout the installation. Training and familiarization with the EMASMAX product by the EMAS CONTRACTOR on the proper handling and installation procedures is very crucial to having a proper quality installation. The training will occur in the initial phases of the EMASMAX block placement process. It is required that the EMAS CONTRACTOR's personnel perform the installation in strict conformance with Zodiac Arresting Systems America's installation specifications and the project submittals approved by Zodiac Arresting Systems America. There shall be no deviations from these specifications without prior written approval from Zodiac Arresting Systems America. **In the event there is a material loss during the installation work due to non-conformance with the handling or installation specifications of the EMASMAX product, the EMAS CONTRACTOR shall replace all material losses at no additional cost to the Owner, Rhode Island Airport Corporation (RIAC).**

Dates for access to the work site and EMASMAX block installation shall be coordinated with the Runway 5 Extension Contractor. It is anticipated that one, daytime, 12-hour shift will be required on a daily basis, excluding Saturdays and Sundays, until the job is completed (estimated to be **11**workdays). It is expected the EMAS CONTRACTOR will make appropriate adjustments to the labor and material requirement in order to meet the installation schedule. In the following labor breakdown estimate, eleven (11)12-hour daytime shifts are assumed, with some arrangements for an early start for the asphalt cement melting kettle warm-up operation. Utilizing one block installation crew (**16** people), normally 660EMASMAX blocks can be installed per shift except for a planned first day quota of 44 blocks, second day quota of 176 blocks, and all subsequent days having a daily expected installation of 660 blocks.

Because training and familiarization with the EMASMAX block placement is crucial to correct installation, EMAS CONTRACTOR will be required to revert to 44 blocks per shift quotas without additional compensation after any significant crew changes. Specifically, if a new crew, in whole or in part, is put in place after initial start-up, the Zodiac Arresting Systems America field representative has the unilateral authority to reduce the daily installation quota to insure proper training is accomplished. That decision will be based upon the magnitude of the crew change and the EMAS CONTRACTOR's demonstrated performance. Additionally, the Zodiac Arresting Systems America field representative shall have the authority to identify and retrain crew any EMAS CONTRACTOR representative who is unable to provide and maintain quality workmanship in the assigned tasks.

All EMASMAX joint taping must be installed to a **High Quality Standard** with minimum overlapping of joints. The specialty joint sealing tape is adhered to the adjoining blocks. This seam sealing tape cannot be stretched, and requires a careful installer. Prior to any blocks being readied for placement the EMAS CONTRACTOR shall be required to demonstrate their ability to apply and finish the tape in a manner acceptable to Zodiac Arresting Systems America. In addition to sealing the joints to prevent moisture intrusion, the finished taped joint must be aesthetically pleasing, i.e. look good. Excess caulk adhesive shall be cleaned up by the EMAS CONTRACTOR to the satisfaction of Zodiac Arresting Systems America. In order to help

achieve the desired result Zodiac Arresting Systems America will provide 2 hours of training in EMAS block joint sealing. This project includes approximately 40,000 linear feet of taped joints with a requirement for about 2,500 linear feet per 8-hour shift once the job is underway. Full and careful consideration of which EMAS CONTRACTOR personnel to assign to this taping work is encouraged, as experience has shown workmen not fully experienced in taping usually do not meet Zodiac Arresting Systems America's quality or workmanship standards thus leading to job delays and rework. Additionally, Zodiac Arresting Systems America's experience has shown that this taping effort will be the task which paces the job, since it is required that all blocks installed during a work shift have a backer rod installed and the joints taped by the end of the shift. The entire thrust of these requirements is to attain and maintain a very high level of placement competence and quality of installation.

If night work is required the EMAS CONTRACTOR shall provide adequate portable lighting for use at the work site before dawn and after dusk. For EMAS installation and finishing work, six large self-contained four-bulb light plants, such as the Allmand MLT 3060 or similar, is the minimum.

Before any shut-down of contract operations, all equipment and materials used at the work site shall be moved by the EMAS CONTRACTOR to the designated airport mobilization site, to assure safe aircraft operations between the EMAS CONTRACTOR's work shifts.

Initial receiving operations at the staging area can be at any time allowed by the airport until installation commences. Upon commencement of block installation receiving operations would be expanded to include access control, which must be coordinated with the work periods at the work site.

The EMAS CONTRACTOR is responsible for setting up the staging area and providing access control, a dumpster, all trash collection and rubbish removal, portable lavatory, and all other requirements for the duration of this project. Control of Foreign Object Damage (FOD) construction materials (block packaging materials, paper wrappers, hand tools, small parts, etc.) that are used during the installation of the EMAS is always of concern to an airport and must be controlled. It will be necessary for the EMAS CONTRACTOR to provide covered containers to hold all construction debris and refuse in at the worksite and/or airport property.

The sequence for installation of the EMASMAX system will be as follows:

- Installation of the concrete anchor beam.
- Installation of jet blast debris deflector
- Mark-out of installation grid (centerline, sidelines, rear edge line, and <u>every block corner with a grid system</u>)
- Installation of the EMASMAX blocks including
  - Placement of backer rod material into block joints as needed
  - Installation of PVC angle material along perimeter
  - Installation of high and low perimeter block vents (sides and back of bed)
  - Install seam seal tape over joints and backer rod
  - Install side coating, (180' rolls)
- Complete any "punch-list" work
- Painting of safety area markings
- Site clean-up and demobilization

Specific works are as detailed on the following pages. Note: where this Statement of Work conflicts with the contract drawings, the contract drawings shall govern.

556-5.2 Receiving and Layout for Runway23 Departure End (Runway 5 End)

a. Receiving. The EMAS CONTRACTOR, at the staging area and utilizing the access route shown on sheet GC101 will receive the trailers containing pre-cast EMASMAX blocks and installation materials. The staging area for this project and access route is shown on sheet GC101. "Receiving duties" are generally limited to acknowledging the trailer delivery by signing the trucker's delivery ticket. The Owner (RIAC) will assist the EMAS CONTRACTOR in escorting the trucker to and from the drop-off point if the haul route is through a secured area. After receiving the EMAS blocks and installation materials, the EMAS CONTRACTOR will assume immediate responsibility and control for the EMAS blocks and installation materials, including the protection of the EMAS materials by securing the staging location during the storage time and prior to installation. Prior to the start of block installation, approximately 20% of the EMASMAX blocks will arrive at the airport. Once installation is underway, the delivery of blocks will continue until all block have been delivered. Zodiac Arresting Systems America shall determine and control the rate of delivery of truckloads of blocks in accordance with the installation rates outlined in this specification, and keep the EMAS CONTRACTOR informed of the delivery schedule. Any requests by the EMAS CONTRACTOR to accelerate the truckload delivery schedule shall be submitted in writing to Zodiac Arresting Systems America Program Manager a minimum of 72 hours prior to the desired adjustment. Zodiac Arresting Systems America does not guarantee that requests to accelerate block delivery schedules will be able to be accommodated.

Blocks will be shipped in 53-foot air-ride suspension trailers. Blocks shipped in advance of installation will be stored at the staging area and will be left secured in the trailers. Blocks will continue to be shipped and received at the staging area during the installation program. The EMASMAX blocks are shipped stretch-wrapped on 4-ft. (1.219m) x 4-ft. (1.219m) pallets.

b. Layout. NOTE: The paved surface upon which the EMASMAX blocks are to be placed must be in compliance to the smoothness requirements of FAA Paving Specification P-401 and to the slope requirements set forth in the Runway 5 Extension project drawings prior to the block grid layout and placement of any EMAS blocks Zodiac Arresting Systems America personnel will check the surface using a straightedge as outlined in the P-401 specification.

Careful layout of extended runway centerline, sides and back edges of the bed rows and steps shall be augmented by field marking one corner alignment point for each of the 4,796 blocks. Because the blocks are not designed to be altered in the field, the field marking for block corners will be crucial for correct block placement, while edge layout lines will provide side and back block placement guidance. A surveyor, licensed in the state in which the EMAS is being installed, shall establish the control points for field layout marking lines, the cost of this work shall be included in the EMAS CONTRACTOR's bid. These control points shall establish the extended runway centerline through the EMAS, EMAS bed perimeter, and interim points both perpendicular and parallel to runway centerline within the confines of the EMAS bed on a 20.25 ft. x 20.25 ft. grid pattern within a tolerance of +/- 1/8 inch. PK nails shall be used to mark these points. The entire grid layout must be completely installed and

accepted by Zodiac Arresting Systems America before any blocks are installed. NOTE: Prior to establishing the points perpendicular to runway centerline, check with Zodiac Arresting Systems America to ensure the debris deflector has been satisfactorily installed and accepted. The grid points will use the back of the deflector channel as the reference base. For marking the grid lines, the EMAS CONTRACTOR should use a durable marking system. Chalk lines and other such marking systems will not remain visible after the large amount foot and vehicular traffic associated with this installation. Experience has shown that a white, painted 1/8" string line grid on the pavement with block heights painted in each box appears to be the simplest and most effective method. A walk behind spray paint unit is recommended and works best in windy conditions.

LAYOUT LABOR FOR RUNWAY 23 DEPARTURE END (RUNWAY 5 END)

Total Men		Days	Area
2	Survey Crew	3	EMAS site

LAYOUT EQUIPMENT FOR RUNWAY 23DEPARTURE END (RUNWAY 5 END)

- Horizontal Survey Equipment with 1/8-inch (plus or minus) accuracy over the area occupied by the EMASMAX Arrestor Bed.
- Surveyor's choice of waterproof and durable grid marking devices**, however, all major points (20.25' grid intersections, rear corner and centerline point) shall be marked with PK nails.**

556-5.3 Installation Phase for PVD Runway 23 Departure End (Runway5 End) The air-ride trailers containing EMAS blocks will be received in the staging area shown on sheet GC101.. The EMAS CONTRACTOR will be responsible for moving trailers to the EMAS installation site as they are needed. The EMAS CONTRACTOR will unload the EMAS blocks and installation materials using a pallet jack and fork lift. Great care must be taken when off-loading the EMAS blocks to prevent damage. The sides of the EMAS block are particularly vulnerable. Fork lift load guards shall be covered with a cushioning material (foam or carpet) to help protect the EMAS blocks. Any foot traffic atop the blocks must be minimized. Anyone walking on the bed must have soft-soled shoes with no sharp heels (Sneakers or flat soled boots preferred). At no time shall any vehicle be allowed to drive on the EMAS.

The jet blast debris deflector supplied by Zodiac Arresting Systems America must be installed before the block layout grid is started and before any blocks are installed. This will protect the runway side of the blocks, and provide a starting point for the grid layout. The primary task involved in the installation of the two-piece Debris Deflector sections will be drilling about 220 each 11/16" diameter x 5" deep holes in the concrete Anchor Beam and the installation of grout-in-place threaded anchors into those holes. The holes must be clear of dust, debris and water. After the anchors are installed, the aluminum Debris Deflector sections are set into position by hand and secured with 3/8" size hex head bolts threaded into the concrete anchors. Due to its frangible nature, people must avoid stepping on the deflector. The deflector comes pre-marked with "NO STEP". Prior to placement of the debris deflector sections, a bead of 100% silicone caulk shall be applied to the surface of the grade beam such that the channel and panel sections of the deflector receive a continuous seal from one edge to the other.

a. Block Placement. Blocks less than 6 inches in height may be placed into position by hand. These lower height blocks have a maximum weight of 200 pounds but because of

their size require four people to lift (one person per block corner). Blocks greater than 6 inches in height will then be placed into position using one of the four (4) EMAS CONTRACTOR-supplied forklifts. Each block will be pushed into its final position as marked on the pavement grid either by hand or using a forklift with a push plate to minimize joint spaces. The push plate adapts to standard forks and one push plate will be supplied by Zodiac Arresting Systems America.

NOTE: The push plate should rarely be used. The blocks will slide easily into place within the first 20 seconds after coming into contact with the hot AC adhesive. Improper usage of the Push Plate may damage otherwise good blocks.

Immediately prior to actually placing blocks, a hot asphalt cement (AC-20) augmented with a crack sealing additive (25% by volume) shall be applied to the area where the block will be placed at a rate of approximately 1.25 to 1.5 gallons per block and a temperature ranging from 350^0F to 375^0F. The hot asphalt cement/crack sealer coating is the bond or anchor device between the overrun surface and the EMAS blocks. The asphalt cement, while still hot, acts as a lubricant between the block and the existing pavement so that blocks will slide easily into their final position when pushed. Zodiac Arresting Systems America's experience has shown that the total elapsed time from when the hot asphalt cement is placed to when the block must be in its final position is approximately 20 to 25 seconds, depending upon ambient temperatures. After that time, the asphalt cement will have cooled sufficiently to bond the block to the pavement and it will not slide easily. If this occurs before the block is in the correct position, the block will have to be removed and replaced with a new block. **An adhered block cannot be removed without being destroyed.**

NOTE: All blocks have a particular orientation when installed. The backside of the block (the side away from the debris deflector) has the nominal height of the block, in inches, marked on that side. The forklift operator should always be facing the side of the block when picking up the block for placement. The block side with the serial (or batch) number faces the runway. The forklift slot in the tray shall be oriented when the block is placed so that it is perpendicular to the runway centerline.

Block spacers, loaned by Zodiac Arresting Systems America, are inserted between the blocks during the block placement process in order to provide a positive control on the gaps between the blocks while the hot asphalt cement is cooling and to simplify the process of block alignment. Once the hot asphalt cement is set, individual spacers are removed and reused.

As the first row of blocks next to the anchor beam is completed, the appropriate size backer rod is inserted into the joint between the blocks at a depth of approximately 5/8-inch from the top of the block, and then caulked. (Note: only the front of the first row is caulked with the Debris Deflector. All remaining block rows are taped). It is a requirement that all installed blocks have backer rod installed (as needed) and be seam seal taped by the end of the work shift. For every vertical side and back row joint between blocks, high and low vents will be installed in the step riser before the block installation any additional rows.

Next, a specialty coating will be adhered to all vertical sides of the completed bed along with 2 inches of overlap onto adjoining horizontal block surfaces. Due to the fact that the

coating material is supplied in roll lengths of 180', it will be required by the EMAS CONTRACTOR to install the side coating every time 44rows (approx. 178') of blocks have been installed. This shall take place prior to the end of the shift.

Finally, the appropriate pavement marking paint will be applied. This last painting phase consists of applying marking paint to indicate the EMAS arrestor bed as unusable pavement. The EMAS CONTRACTOR will supply the marking paint, any reflectorized beads to be used with it, and all labor under a separate pay item.

Lastly, the empty pallets are neatly stacked, banded and loaded back onto trailers by the EMAS CONTRACTOR for shipment back to the EMAS production facility. Note that some blocks will be damaged during transport, off-loading and installation. The EMAS CONTRACTOR must exercise care to minimize these losses for blocks under his care. The EMAS CONTRACTOR is responsible for removal of and disposal of any damaged block material. Extra pallets of good blocks left over at completion of installation will be stacked, corner-protected, plastic-wrapped, and re-loaded onto trucks by the EMAS CONTRACTOR and transported back to Zodiac Arresting Systems America.

Approach lights within the EMAS will be identified after grid layout. The EMAS CONTRACTOR shall prep the affected blocks to be installed at the light using coring techniques, shall dry-set the blocks (for future removal), shall equip the blocks with Zodiac Arresting Systems America-supplied lifting straps and weatherproof boots for the approach lights, and shall seal the blocks to prevent water incursion. All activities associated with the affected blocks will be conducted per the instructions of the Zodiac Arresting Systems America representative.

b. Debris Disposal. It is the EMAS CONTRACTOR's responsibility to ensure all stretch wrap, plastic padding, and cardboard corner protectors (packing material) used to protect the blocks during transit, and all other debris generated by this project be collected at the work site, including the staging area, and properly disposed of off-site. All debris transport and disposal shall be in accordance with all applicable federal, state and local regulations. Recycling of materials, especially cardboard products, is strongly encouraged.

While within the aircraft operations area, care must be taken to ensure that all debris is collected and stored in covered containers to mitigate Foreign Object Damage (FOD) to aircraft. The cardboard spacers shipped between the blocks need to be collected, stacked and banded for return shipment to Zodiac Arresting Systems America. Empty pallets will also be packaged in this manner for return shipment.

556-5.4 Installation Labor For Runway23 Departure End (Runway5 End)

Total Laborers	Person	Installation Days	Area	Responsibility
1	Foreman	11	Work Site	Coordination and Supervision
1	Truck Driver	11	Work Site & Staging Area	Transport Blocks and Materials to/ from Staging Area and Installation Site
4	Forklift Operators	11	Work Site	2-Unload truck/push blocks and 2-handle blocks
4	Laborers	11	Work Site	Operate Pallet jack during truck loading and unloading, Remove and dispose of shrink wrap, collect and dispose of padding between blocks, Install debris deflector, apply hot tar, Install block, vents, paint pavement/EMAS yellow chevrons and cleanup
6	Caulkers/ Tapers	11	Work Site	Install backer rod, tape, caulk and side coating

556-5.5 Installation Equipment for Runway23Departure End (Runway5 End)

Total Equipment	Equipment	Installation Days	Area
4	*5000# Pneumatic Tire Forklift	11	Work Site
1	Push Plate **(Zodiac Arresting Systems America supplied)**	11	Work Site
1	Tractor to move trailers to work site	11	Work Site & Staging Area
2	**Pallet jacks	11	Work site
1	Tar Kettle with buckets or pump and hose	11	Work Site
6	Light plants with fuel (If needed)	11	Work Site
1	40 cu yd dumpster (covered) for damaged blocks and trash	11	Work Site
As required	Caulk application equipment (battery operated, dual cartridge caulk guns recommended)	11	Work Site
As required	Debris Deflector installation tools	1-2	Work Site

* All forklifts must have lateral load shift capability.
** One pallet jack supplied by Zodiac Arresting Systems America. 2nd pallet jack is optional – will expedite handling.

Note: To the maximum extent practical, all equipment should be on site at the start of the installation phase to insure that it will be available when needed.

556-5.6Zodiac Arresting Systems America Supplied Installation Materials for Runway23DepartureEnd (Runway5 End)

Material	Quantity
EMASMAX Adhesive	6,800 gallons (Approx. 1.5 gal/block - 90% coverage)
Pallet jack for interior trailer unloading and reloading	One**
Side Vents	Approx. 800
Jet Blast Debris Deflectors	22 Each
Jet Blast Debris Deflector Anchors	220 anchors
Adhesive Sealant Material	3,384 Tubes
Backer Rod (¾" and 1") Closed-Cell polyethylene foam Chemrex, Inc. 889 Valley Park Drive Shakopee, MN55379 (800) 243-6739	Total of linear feet 1,100 ft. ¾" 600 ft. 1"
Seam Seal Joint Tape Side Covering	36,720 linear feet -2 ½" 3,420 LF – 10"
Sealant, 3M Marine Caulk Sealant, 100% Silicone	48 tubes 70 tubes
Weatherproof Boots for Approach Lights	30

IMPORTANT NOTE:

This list includes most of the supplies required of the EMAS CONTRACTOR as well as the material and equipment to be provided by Zodiac Arresting Systems America.

556-5.7 Suggested Construction Schedule for Runway23DepartureEnd (Runway 5 End)

DAY	ACTIVITIES
1-2	Surveyors check grade beam. Laborers install debris deflector.
2-3	Surveyors establish grid layout points. Laborers start marking grid.
2	Train Tapers & Forklift Operators
3-10	Install blocks, backer rod, tape, side seal, side vents, and caulk
10-11	Inspection/Punch list

556-6.1Quality Control. The EMAS CONTRACTOR must place and finish the EMAS bed under the guidance of the EMAS manufacturer's technical support, following the EMAS installation specification and Quality Control Plan as approved by the Engineer.

METHOD OF MEASUREMENT

556-7.1 MEASUREMENT. Measurement shall be per lump sum installed, completed, and approved EMASMAX EMAS system, including concrete anchor beam.

BASIS OF PAYMENT

556-8.1PAYMENT. Payment shall be made at the contract unit price per lump sum. This price shall be full compensation for the Complete EMASMAX Engineered Material Arresting System (concrete anchor beam, all EMASMAX materials, all materials placed on the pavement and on the EMAS excluding paint and delineators), transport and delivery of the EMAS materials, installation of the supplied EMASMAX system materials, EMAS required layout/survey and for all labor, equipment, tools, and incidentals necessary to complete the installation of the complete EMASMAX system. Also included in the cost of the EMAS system shall be all of the labor, tools, testing, shop drawing reviews, mobilization of all men and equipment for the Runway 5 Extension – EMAS System project, installation, maintenance, removal and site restoration of all temporary haul roads necessary to perform EMAS work, all maintenance and protection of traffic required for the Runway 5 Extension – EMAS System project including but not limited to: flag person(s), gate guard(s), restoration of all surfaces disturbed as a result of the EMAS Contractor's Operations including but not limited to staging area and haul roads, construction drawings signed by a Rhode Island Professional Engineer and the Manufacturer's full time inspection of the EMAS system installation and EMAS system certification. In the event that a portion of the EMAS bed is installed during the processing of a payment application, at the sole discretion of the Engineer, the Engineer has the option to use a percentage of completion to determine partial payment. **No payment will be made for EMAS materials on hand until it is successfully installed and accepted.**

Payment will be made under**:**

Item SP-556-1 Zodiac Arresting Systems America Engineered Material Arresting System (EMAS) - per Lump Sum

MATERIAL REQUIREMENTS

ASTM D 946 Asphalt Cement for Use in Pavement Construction

END OF ITEM SP-556

Item SZ-100 Runway Safe Engineered Material Arresting System (EMAS)

DESCRIPTION

100-1.1 General.

a. This item shall consist of the installation of a Runway Safe EMAS bed as listed below, on the prepared EMAS support pad in accordance with the plans, these specifications and the Manufacturer's requirements at the locations noted in the plans.

b. The work under this item includes, but is not limited to: construction of a mock-up EMAS for the purpose of demonstrating installation procedures for construction of the proposed EMAS; installation of the proposed EMAS system. The EMAS and mock-up shall consist of silica foam and controlled low strength material (CLSM) as shown in the plans. The proposed EMAS system and mock-up are comprised of a recycled, energy-absorbing loose fill material placed and consolidated in bays that are separated by a geogrid system; a protective cover layer comprised of a pour-in-place CLSM cover slab, topped with a weather-proof top coat, and a sub-structure for anchoring the bed to the underlying EMAS support pad. The weather-proof top coat and expansion joint installation is not required for the mock-up. Also included in this work shall be the milling required as shown in the QJ series of the Contract Drawings. This work shall be completed in accordance plans, specifications, and Manufacturer requirements to the satisfaction of the Owner.

c. All work shall be done during the day 7am to 7pm unless otherwise noted.

d. Manufacturer shall approve all materials and construction equipment.

e. Manufacturer shall have an inspector on-site at all times to approve installation and shall supply the Owner with a certification that it was installed in accordance with the manufacturer's requirements.

f. Additional requirements related to the EMAS design and construction are included in specification section SP-555.

100-1.2 Submittals.

a. Shop Drawings or Product Data. The EMAS Contractor must submit the shop drawing documents for materials from the supplier for review a minimum of 120 days prior to beginning EMAS installation. Manufacturer approved shop drawings shall be submitted to the Engineer a minimum of 90 days prior to beginning EMAS installation. This submittal should include all the pertinent information as it relates to the construction of the EMAS, including, but not limited to:

1. CONTROLLED LOW-STRENGTH MATERIAL (CLSM)
2. METHYL METHACRYLATE (MMA) POLYMER CONCRETE
3. GEOGRID
4. FILTER FABRIC
5. CHANNEL STRUT
6. EARTH ANCHORS AND CLIPS
7. FLAT UNDERDRAIN WITH FILTER SOCK
8. NON-PERFORATED OUTLET PIPES WITH SCREW TYPE END CAPS
9. EXPANSION JOINT

10.CONSTRUCTION EQUIPMENT

b. Installation Drawings. The EMAS Contractor must submit the schedule of installation for each EMAS system to meet the Contract limitations within 15 days from the issuance of the Notice to Proceed. Manufacturer approved Installation Drawings (5 copies) that are signed and sealed, by a Rhode Island Professional Engineer shall be submitted to the Engineer a minimum of 30 days prior to the date on the Notice to Proceed.

c. Performance Reports. Preliminary and Final EMAS Design Reports. No EMAS construction shall begin prior to FAA approval of both of these reports.

d. Cleaning and Maintenance. The EMAS Contractor is to provide a Manufacturer approved cleaning and maintenance plan in a form of Record Documents to be handed over to the Owner for use. This plan should include detailed description of equipment to be used for maintenance, detailed description of maintenance and repair procedures, the record shop drawings that indicate the actual installation sequence and the as-built drawings for the new replacement EMAS system. This shall be submitted to the Owner, through the Engineer, within 14 days of completion of installation. The EMAS system will not be considered accepted until the Owner receives the as-builts.

e. Certification of EMAS. The EMAS Contractor shall provide, upon completion of the installation, written certification that the EMAS System meets the requirements of the contract Plans, these specification and the Manufacturer requirements. This certification shall be from the Manufacturer and shall be submitted to the Owner, through the Engineer, within 14 days of completion of installation. The EMAS system will not be considered accepted until the Owner receives the Manufacturer's Certification.

100-1.3 Quality Assurance

a. The Manufacturer shall be on site at all times during the installation of the EMAS system and shall be allowed to pull silica foam and CLSM samples and perform Dynamic Cone Penetration (DCP) testing on the compacted silica foam beds and perform moisture and thickness measurements of the CLSM. The cost of these services shall be included in the cost of the EMAS.

b. The EMAS Contractor shall perform testing of the CLSM mix prior to installation of the material on the bed or mock-up. Results of testing shall be provided to the Owner and Manufacturer and approved before proceeding with placement. See Section Z100-2.3: Cementitious Low Strength Materials (CLSM) for testing requirements.

c. The EMAS Contractor shall perform testing of the moisture content of the CLSM prior to application of the MMA. See Section Z100-2.4 Methyl Methacrylate (MMA) Polymer Concrete for testing requirements.

100-1.4 Delivery, Storage and Handling.

a. All materials should be handled, delivered and stored in accordance with the Manufacturer's recommendations. This will include the receipt and stockpiling of the silica foam material in bulk. The EMAS Contractor will be responsible for ensuring all other components are stored and handled per the

respective manufacturer's requirements. EMAS Contractor staging area and access route is shown on sheet GC101.

100-1.5 Other Requirements.

a. Field Measurements. Before proceeding with the installation of the proposed installation of the EMAS, the EMAS Contractor must verify all dimensions and take such measurements as required to verify support pad has been constructed in accordance with the Runway 5 Extension design documents. The EMAS Contractor shall survey the EMAS support pad upon its completion to verify and establish the grade and slope of the pad, and provide a layout of anchor and channel strut locations prior to the new EMAS installation. Survey data will be furnished to the Owner.

b. Mock-up. The mock-up, to be constructed prior to any work on the new EMAS, shall use the same equipment, materials and construction methods as given in this specification. Once CLSM is placed, no further construction is required for the mock-up. The mock-up is a smaller version of the EMAS system used to demonstrate and verify that construction of the EMAS system will occur within the contract duration. The mock-up shall have overall dimensions of 10-ft at the front of the bed, 20-feet at the rear of the bed, and an overall length of 80-feet from front to back. A single ramp and plateau are required and the break occurs 40-ft from the front of the bed. Side ramps with max dimensions of 5-feet are required at the sides and rear of the bed. Upon completion of the mock-up, the EMAS Contractor will be responsible for demolition and removal of the mock-up.

c. Coordination. Coordinate work in this section with the Owner and as a Subcontractor to the Runway 5 Extension project Contractor.

d. Existing Utilities. Composite Utility plans are provided for the EMAS Contractors aid, but shall not be construed as being correct or complete. The EMAS Contractor is responsible for verification of type and location of underground utilities as necessary to avoid damage thereto.

EQUIPMENT AND MATERIALS

100-2.1 General.

a. The equipment and materials to be used for the EMAS construction shall be provided by the EMAS Contractor. Equipment and tools necessary for handling materials and performing all parts of the work will be accepted by the Manufacturer as to design, capacity, and mechanical condition and submitted to the Owner as part of the Shop Drawing submittal. The equipment must be at the job site sufficiently before the start of construction operations for examination and acceptance. For equipment used for compaction of the silica foam, installation of MMA and Joints, model numbers and ground pressure ratings must be provided.

b. The EMAS Contractor must provide sawing and milling equipment as well as trucking adequate in number of units and power to complete the sawing and milling to the required dimensions. Saws used in the cutting of joints in the CLSM shall not exceed 5 PSI ground pressure. The EMAS Contractor must provide at least one standby saw and milling unit in good working order. An ample supply of saw blades and milling heads must be maintained at the site of the work at all times during sawing and milling operations. The EMAS Contractor must provide adequate artificial lighting facilities for required night sawing of the CLSM. All of this equipment must be on the job both before and at all times during saw

cutting and milling operations.

c. The equipment used for removal of the bituminous concrete and/or Portland cement concrete materials shall consist of a self-propelled cold milling machine capable of cutting the existing bituminous concrete and/or Portland cement concrete surface and depositing the millings in a windrow or loading the millings directly into trucks. The cold milling machine shall be capable of removing, in one pass, a bituminous and/or Portland cement concrete layer at least 1 foot 6 inches wide and 3 inches deep. The milling machine shall be capable of accurately and automatically establishing profile grades by reference from either the existing pavement or an independent grade control to provide a milled surface within a tolerance of 3/16 inch (5 millimeters) in 16 feet (5 meters) when tested with a 16-foot (5-meter) long straightedge. The cold-milling machine shall also have an effective means for removing all loose and excess material from the surface and preventing any dust resulting from the operation from escaping into the air.

d. The existing bituminous concrete and/or Portland cement concrete surface shall be removed to the depth designated in the plan drawings. The temperature at which the cold milling work is performed, the nature and condition of the equipment, and the manner of performing the work shall be such that the milled surface is not torn, gouged, shoved or otherwise damaged by the milling operation. Sufficient cutting passes shall be made so that all irregularities or high spots are eliminated to the satisfaction of the Manufacturer. When tested with a 16-foot (5-meter) straightedge, the planed or milled surface shall have no surface variations in excess of 3/16 inch (5 millimeters).

e. Removing the existing bituminous concrete surface to the required depth adjacent to structures in the pavement surface, such as drain castings and utility covers, shall be accomplished in a manner satisfactory to Manufacturer using either machine or hand methods.

f. Materials resulting from the cold milling operation shall be disposed of legally by the EMAS Contractor at a disposal site off of the airport. Disposal of the material shall be performed in a manner approved by the Owner.

100-2.2 Silica Foam. Silica foam material shall be approved by the Manufacturer. The EMAS Contractor shall be responsible for producing enough processed silica foam for final grading of the bed, where necessary, prior to placement of the CLSM. The processed silica foam shall reduce the silica foam aggregates to between ½-inch and ¾-inch in size, (nominal silica foam aggregates are 2 or more inches in size). The EMAS Contractor shall be responsible for providing enough processed material for final grading, if needed, to bring top of consolidated silica foam to required heights as reflected in the drawings. As an estimate only, assume that ½-inch +/- ¼-inch of the processed material will be required over the surface of the beds. The Manufacturer shall approve the processed material prior to its use for final grading of the silica foam.

100-2.3 Controlled Low Strength Material (CLSM).

a. The CLSM shall consist of a cement, sand, and polypropylene reinforcement necessary to achieve specified strengths. Reinforcement shall consist of 3-lb per cubic yard of mix.

b. The CLSM shall provide compressive strengths of 150 psi @ 3 days, 200 psi @ 15 days and a maximum of 300 psi @ 60 days. Slump shall be 6”. Compressive tests shall be done using 3x6 cylinders. Testing shall be performed at a minimum, every 50 cubic yards. Each sample set shall include 15 cylinders. Results of tests confirming strength performance at 3 days, 15 days, 30 days, 60 days and 100 days shall be

provided for approval in order to establish conformance with specifications. The Manufacturer shall be responsible for review and approval of CLSM mix design. Once an approved mix is provided, no changes to the mix will be allowed without approval by the Manufacturer. The EMAS Contractor shall be responsible for Quality Control Testing. The Manufacturer will reserve the right to perform Quality Assurance Testing at their discretion.

c. Testing shall be done in accordance with the following references: Grout sampled according to ASTM C 1019-13, Test specimens made and stored according to ASTM C 511-13, Temperature of grout measured according to ASTM C 1064-12, air- content measured according to ASTM C 939-10, tested in accordance with ASTM 1019-13, specimens capped in accordance with ASTM C 617-12 or C 1231-13. The EMAS Contractor shall be responsible for Quality Control Testing. The Manufacturer will reserve the right to perform Quality Assurance Testing at their discretion.

100-2.4 Methyl Methacrylate (MMA) Polymer Concrete.

a. For entry ramp, plateau, and side ramps of the EMAS system, a pre-packaged MMA based water proofing slurry system shall be used. The system shall consist of a MMA primer, MMA primary binder with broadcast stone topcoat, and followed by a MMA Top Coat. The MMA primary binder shall be thixotropic, and the MMA primary binder neat resin have an elongation of 70% or greater. MMA primary binder shall be spray applied to a thickness of 0.090-inches +/- 0.020-inches after primer has been applied and allowed to cure per MMA manufacturers recommendations. Only MMA material that has been accepted by the FAA shall be used and substitutions with similar materials shall not be allowed. Primer and MMA to be applied to the top of the CLSM shall be no sooner than 14 days after CLSM placement, but in no case sooner than the results of testing per the requirements of ASTM D4263 shows no moisture on a plastic sheet. For sampling purposes, the EMAS shall be divided into quadrants, with one sample taken per quadrant.

Chevrons shall be laid out and applied to the top of the EMAS bed using a colorized MMA material approved by the Manufacturer and shall be applied at the same thickness and have the same properties as given in paragraph a. above.

100-2.5 Geogrid. Geogrid shall have nominal 1-inch square pattern and have a minimal ultimate tensile strength of 2,050-lbs per ft. in the cross main direction.

100-2.6 Filter Fabric. Filter fabric shall be a 3 oz. non-woven polypropylene material.

100-2.7 Channel Struts. Channel Struts shall be slotted and have a minimum simple beam uniform load capacity of 1,636-lbs for a 48-inch support spacing with a deflection equal to or less than 0.153-inches when using an allowable stress of 25,000-psi. Channel Strut shall be pre galvanized and meet the requirements of ASTM A653 with minimum yield strength of 33,000-psi. Additionally the channel strut shall be equal to or less than 3-inches in height in the vertical installed position. Dimension shown on the drawing are nominal and not required for compliance but do suggest a size where installation of the asphalt anchor bolt will be easy.

100-2.8 Anchors. Two types of acceptable anchors exist for securing the Channel Struts to the asphalt pad. These are outlined below.

a. Earth Anchor. Earth anchors shall be a minimum of 10-inches in length, and supplied with 12-gauge steel hold down clips. The anchor shall be pull rated for 1,000-lbs when tested in asphalt. Earth anchors shall be installed after an appropriate sized pilot hole, per anchor manufacturer's recommendations,

is drilled into the asphalt and underlying soil. As a minimum, anchors shall be spaced no closer than 12-inches on center. Based on current specified strengths of channel struts and anchors, maximum spacing of anchors is 4'-0".

b. Asphalt Anchor. Asphalt anchors shall be a minimum of 6-inches in length, nominally 5/8 inch in diameter and supplied with appropriate bolts, washers, and lock washer. The anchor shall be pull rated for 1,500-lbs and have a shear capacity of 1,000-lbs. Asphalt Anchors shall be installed in minimum 7/8 inch diameter holes and grouted in place per anchor manufacturer's recommendations. As a minimum, anchors shall be spaced no closer than 6-inches on center. Based on current specified strengths of channel struts and anchors, maximum spacing of anchors is 4'-0".

100-2.9 Flat Underdrain With Filter Sock and Non Perforated Outlet Pipes.

a. Perforated Flat Underdrains and Fittings must meet the requirements of ASTM D 7001. Acceptable products are AdvanEDGE (Advanced Drainage Systems, Inc) or approved equal.

b. Outlet pipes shall be smooth-wall non perforated PVC pipe, schedule 40, meeting the requirements of ASTM F758. A screw type end cap shall be provided for each outlet pipe. The screw type cap shall have an external square extrusion that may be gripped by hand to loosen and remove the end cap.

c. Filter sock must be installed and slipped over the entire length of the perforated underdrain. The sock shall be seamless, knitted polyester fabric to prevent sediments from clogging the pipe perforations.

100-2.10 Expansion Joint.

a. Sealant system shall be comprised of three components: 1) cellular polyurethane foam impregnated with hydrophobic 100% acrylic, water-based emulsion, factory coated with highway-grade, fuel resistant silicone; 2) field-applied epoxy adhesive primer, 3) field-injected silicone sealant bands. Impregnation agent to have proven non-migratory characteristics. Silicone coating to be highway-grade, low-modulus, fuel resistant silicone applied to the impregnated foam sealant at a width greater than maximum allowable joint extension and which when cured and compressed will form a bellows. Depth of seal as recommended by joint manufacturer. The foam seal to be installed into joint manufacturer's standard field-applied epoxy adhesive. The foam system is to be installed recessed from the surface such that when the field-applied injection band of silicone is installed between the substrates and the foam-and-silicone-bellows, the system will be flush with the substrate surface.

b. Material shall be capable of movements of +50%, -50% (100% total) of nominal material size. Changes in plane and direction shall be executed using factory-fabricated "Universal 90" transition assemblies. Transitions shall be watertight at inside and outside corners through the full movement capabilities of the product.

c. All substitute candidates to be certified in writing to be free in composition of any waxes or asphalts, wax compounds or asphalt compounds. All substitute candidates shall be certified in writing to be: a) capable of withstanding 150°F (65°C) for 3 hours while compressed down to the minimum of movement capability dimension of the basis of design product (-25% of nominal material size) without evidence of any bleeding of impregnation medium from the material; and b) that the same material after the heat stability test will self-expand to the maximum of movement capability dimension of the basis-of-design product (+30% of nominal material size) within 24 hours at room temperature 68°F (20°C).

d. Nominal sizes of sealant system are as indicated in the drawings.

CONSTRUCTION METHODS

100-3.1 General. The EMAS Contractor shall construct the new EMAS bed at locations shown on the plans and described in this specification according to the schedule approved by the Owner. The Manufacturer has developed a passive aircraft arrestor system utilizing their silica foam product and a cover layer for the system as an integral and functional component for jet blast protection as well as for tuning the overrun dynamics. Representatives from the Manufacturer will be present at the construction site during the installation of the EMAS bed. The installation of the EMAS will be according to the plans, specifications and the Manufacturer field representative and the approval of the Owner.

100-3.3 Installation of New EMAS

a. Support Pad Preparation. The EMAS support pad must be cleaned by sweeping, scraping, or by other methods as required to remove dust, debris, and materials without damage to the support pad, prior to the installation of the new EMAS bed.

b. Layout. Layout of the bed shall be per the issued for construction drawings.

c. Saw Cuts and Milling. Saw cuts shall be a minimum of ½-inch wide by 3-inches deep at front of bed and 1-1/2-inches wide by 3-inches deep at sides and rear of bed. Milling shall be to the inside of the saw cut and shall be 3-inches deep by 18-inches wide on the sides and rear of the bed and per the plan dimensions across the front of the bed.

d. Anchors. Asphalt anchors shall be installed at a nominal 4-ft on center for the length of the EMAS bed per current material specifications. Anchors shall be installed per the requirements of the selected anchor type and anchor manufacturer recommendations.

e. Channel Strut. Channel Strut shall be located and anchored per the issued for construction drawings.

f. Flat Underdrain With Filter Sock and Non Perforated Outlet Pipes. Flat underdrain, filter sock, and non-perforated outlet pipes shall be installed as shown on the plans and directed by the Manufacturer. On both the inside and outside of the flat underdrain, perforations must be free of cuttings or frayed edges, and any materials that would reduce the effective opening. All perforated underdrain pipes must be wrapped over their entire length with a filter sock. Install filter sock per drain manufacturer's recommendations. The pipe must be laid accurately as shown on the plans. Filter sock must be installed and slipped over the entire length of the perforated underdrain pipe. The sock shall be a seamless, knitted polyester fabric to prevent sediment from clogging the pipe perforations. End caps shall be screw type.

g. Geogrid. Geogrid shall be pre-attached to the unistrut with zip ties or other approved means. Prior to attachment it shall be folded to heights given in the issued for construction drawings. After installation of filter fabric it shall be cut at 12 to 18-inch spacing and folded in alternate directions. Tabs shall be

secured with zip ties (excess cut off) to form an angle of 90-degrees to the vertical. Other methods to secure the tabs at 90-degrees may be used if approved by the Manufacturer prior to use. Height of tabs above filter fabric shall be neither less than ½-inch nor more than 1-1/2-inches.

h. Silica Foam. Silica foam shall be conveyed to locations between geogrid and filled to heights shown in the issued for construction drawings. The geogrid shall be vertically supported during the course of fill operations. Silica foam shall be raked to achieve required fill heights to the satisfaction of the on-site manufacturer's representative. After fill operations, the silica foam shall be consolidated to specified heights as shown in the issued for construction drawings. Consolidated heights shall be verified by laser leveling in the presence of the manufacturer's representative. Low spots in the bed shall be filled with finer silica foam material to bring it to required height. Equipment used for compaction shall have a nominal 5-psi track pressure.

i. CLSM. CLSM shall have a finished thickness of 2 to 2.5-inches. When the CLSM has reached 150-psi, the EMAS Contractor shall cut in construction joints that are no greater than 20-ft by 20-ft as shown in the design documents. After set, CLSM thickness shall be mapped and verified by the Manufacturer. Should thickness less than or greater than those specified occur, additional mapping in those areas will be required and a recommendation as to removal and replacement made at that time by the Manufacturer. Cost of the removal and replacement of the unacceptable thickness of CLSM will be paid by the EMAS Contractor with no additional cost to the Owner. Forms for expansion joints in CLSM shall be with heavily oiled rigid materials such as wood, steel, or other approved material. Styrofoam shall not be used to form joints.

j. MMA Overlay. The MMA material shall be installed per the MMA manufacturer's recommendations. Final thickness of the material shall be 0.090-inches +/- 0.020-inches. The MMA material shall be installed after the CLSM is cured and water content has dropped such that the results of testing per the requirements of ASTM D4263 shows no moisture on a plastic sheet as given in paragraph Z100-2.4.a.

k. Expansion Joint. Expansion joint material shall be installed after the CLSM is cured, form material removed, and water content of the CLSM has dropped such that the results of testing per the requirements of ASTM D4263 shows no moisture on a plastic sheet as given in paragraph Z100-2.4.a. Installation shall be per the joint manufacturers recommendations. All sealant material shall be installed using a joint manufacturer's recommended epoxy adhesive. The expansion joint may be installed prior to or after MMA application. If installed prior to MMA application, the joint material shall be protected from the MMA overlay material.

l. Contraction Joints. Contraction joints shall be cut into the bed after the CLSM has reached a strength of 150-psi at 3-days. The contraction joints on the surface of the bed shall be filled with a self-leveling silicone meeting the requirements of ASTM D5893-96. Contraction joints on the side and back ramps shall be filled with a non-sag silicone sealant meeting the requirements of ASTM D5893-96 Joint sealant shall be protected from the MMA overlay material.

100-3.4 Pavement Marking.

a. This work consists of the applications of markings and stripes on the new EMAS bed, existing support pad in accordance with the latest edition of the FAA Advisory Circular 150/5340-1K and at locations shown on the Plans or as directed by the Owner. Use of an MMA material meeting color requirements shall be used.

b. The EMAS Contractor shall take all necessary precautions and care to avoid damaging the newly installed EMAS bed. Any damage shall be inspected by the Manufacturer and repaired to the satisfaction of the Owner at the EMAS Contractor's expense.

100-3.5 Cleaning and Restoration of the Site. The EMAS Contractor shall restore all areas disturbed by operations related to the installation of the new EMAS bed, to their original condition or as directed by the Owner.

METHOD OF MEASUREMENT

100-4.1 Measurement. Installation of the new EMAS system will be measured per lump sum.

BASIS OF PAYMENT

Delineators for the EMAS system shall be completed as part of the Runway 5 Extension project and is not paid for under this item.

100-5.1 Payment. Payment shall be made at the contract unit price per lump sum. This price shall be full compensation for all labor materials, tools, testing, equipment and all work necessary to complete the installation of the new EMAS system as shown on the plans, these specifications, and Manufacturer's requirements and as directed by the Owner. This shall include all work required for the EMAS system that is above the EMAS support structure, constructed by others, (milling of EMAS support structure shall be included in this item). Also included in the cost of the EMAS system shall be all of the labor, tools, testing, shop drawing reviews, mobilization of all men and equipment for the Runway 5 Extension – EMAS System project, installation, maintenance, removal and site restoration of all temporary haul roads necessary to perform EMAS work, all maintenance and protection of traffic required for the Runway 5 Extension – EMAS System project including but not limited to: flag person(s), gate guard(s), restoration of all surfaces disturbed as a result of the EMAS Contractor's Operations including but not limited to staging area and haul roads, construction drawings signed by a Rhode Island Professional Engineer and the Manufacturer's full time inspection of the EMAS system installation. In the event that a portion of the EMAS bed is installed during the processing of a payment application, at the sole discretion of the Engineer, the Engineer has the option to use a percentage of completion to determine partial payment. **No payment will be made for EMAS materials on hand until it is successfully installed and accepted.**

Payment will be made under:

Item SZ-100 Runway Safe Engineered Material Arresting System (EMAS) - Per Lump Sum

MATERIAL REQUIREMENTS

Advisory Circular (AC) 150/5220-22B
Engineered Material Arresting Systems (EMAS) for Aircraft Overruns

AC 150/5340-1L	Standards for Airport Markings
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C 511-13	Standard Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
ASTM C 617-12	Standard Practice for Capping Cylindrical Concrete Specimens
ASTM C 939-10	Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM C 1019-13	Standard Test Method for Sampling and Testing Grout
ASTM C 1064-12	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C 1231-13	Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D5893-96	Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements
ASTM D 7001	Standard Specification for Geocomposites for Pavement Edge Drains and Other High-Flow Applications
ASTM F758	Standard Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage

END OF ITEM SZ-100