Date: March 8, 2017

Subject: Invitation for Bid No. 25965
DVR Systems
Addendum No. 1

Dear Sir/Madam:

Addendum No. 1 is being issued for changes to correct, amend, add and / or delete certain words, phrases, sentences or paragraphs in Metra Invitation for Bid No. 25965.

1. The bid opening will change from: March 9, 2017
To
March 17, 2017

2. Below are Contractor questions and Metra’s responses:

<table>
<thead>
<tr>
<th>No.</th>
<th>Contractor Questions</th>
<th>Metra Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Will it be required to include an exterior mounted antenna for wi-fi offloading?</td>
<td>An exterior mounted antenna is not required in the scope of work. See revised 3.2.18 in specification M-17-001. An internal Wi-Fi card and antenna will be acceptable as options.</td>
</tr>
<tr>
<td>2</td>
<td>Can you please provide photos of the DVR cabinet in the Locomotives that were not presented at the pre-bid meeting?</td>
<td>See attachment of locomotive cabs.</td>
</tr>
<tr>
<td>3</td>
<td>Is there a projected award date?</td>
<td>See Exhibit 1-B, Information To Bidders – Supplies/Equipment, No. 4: Bids shall be irrevocable for a period of ninety (90) days after the opening thereof by Metra.</td>
</tr>
<tr>
<td>4</td>
<td>What is an acceptable lead time to deliver FAI systems after award?</td>
<td>60 days after the Notice to Proceed, as per the price list.</td>
</tr>
<tr>
<td>5</td>
<td>The current cable spec that commuter rail systems requires SFT cable, does Metra require their Ethernet cables run inside the locomotives and cab cars need to be smoke flame and toxicity compliant?</td>
<td>Yes, see 3.5.3 of Specification M-17-001.</td>
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<tr>
<td>6</td>
<td>3.2.19 Based on IP65 - Metra is asking for a water resistant LDVR system? - This is an electronic component; can Metra please confirm this IP rating?</td>
<td>See 3.2.19 in revised specification: M-17-001 Rev A.</td>
</tr>
</tbody>
</table>
| 7 | Regarding the Fast Act and RSAC committee - Will Metra provide the latest agreed to documents of the working committee? As we understand this committee is still meeting and as of today, nothing is final. | FAST Act: https://www.congress.gov/bill/114th-congress/house-bill/22/text SEC. 11411. RECORDING DEVICES.  
RSAC news: https://rsac.fra.dot.gov/news.php  
DVR systems must comply with most recent revision of FRA 49 CFR Part 229 and FAST Act at the time bids are due. |
| 8 | 3.3.2.12 Each inward facing camera shall have at minimum IP 44 rating - Is Metra sure they only want IP44? The FF cameras are IP65 | As per 3.3.2.12, Metra requires a minimum IP 44 rating for each inward facing camera |
| 9 | 3.3.3.1 Can Metra Clarify rear facing cameras on locomotive - 1 on each side (Engineer, Fireman) - 1 camera by headlight (does Metra want a twin view or just a single camera? | As written per Metra Specification M-17-001 Revision A section 3.3.3.1, the minimum requirement is a single lens camera for each of the identified rear-view camera locations. |
| 10 | 3.5.14 Is USB necessary if all the features can be done through a laptop over Ethernet connection? | See 3.5.14 in revised specification: M-17-001 Rev A. |
| 11 | 3.5.15 What is the DIO port going to be used for? | Metra has no current use for the DIO port. It is anticipated that such a port will be used in the event Metra adopts future technology. |
| 12 | Spec 3.8.10 Calls out see spec 3.9 -There is no 3.9 can you tell us what spec we should review? | See 3.8.10 in revised specification: M-17-001 Rev A. |
| 13 | For Sole source and option procurements Metra will conduct a price and/or cost analysis of the Bid as set forth in FTA Circular 4220.1F. Bidder does not have accounting mechanisms in place to perform 4220.1F (FAR Part 31) cost accounting. May we include language providing for alternative means of conducting audits? | No.  
See Bid Submittal Checklist, H. Additional Notes:  
- Bidders are cautioned NOT to qualify their bid by modifying the Contract documents, either by ALTERATION or by SUPPLEMENTAL STATEMENTS.  
- All bids are to be made in accordance with these specifications and Terms & Conditions. Bids which are NOT so made may be rejected as NONRESPONSIVE.  
Metra may require the lowest responsive and responsible bidder to provide details regarding its pricing as part of Metra’s price and/or cost analysis of the lowest bid. In the event the bidder does not provide sufficient level of detail demonstrating compliance with FTA Circular 4200.1F (FAR Part 31), Metra may deem the bidder to be non-responsive. |
| 14 | **EXHIBIT 1 – C PURCHASE ORDER/CONTRACT INSTRUCTIONS**  
Bidder shall notify Metra’s Department Head of Procurement, in writing, when 80 percent of the Purchase Order Total has been committed. The successful Bidder agrees that the successful Bidder will absorb costs of material or services that exceed the stipulated amount on a Blanket Purchase Order if the supplier has not notified Metra that it has reached the stipulate percentage of the total authorization of the Contract.  
May we delete this section? | No.  
See Bid Submittal Checklist, H. Additional Notes:  
- Bidders are cautioned NOT to qualify their bid by modifying the Contract documents, either by ALTERATION or by SUPPLEMENTAL STATEMENTS.  
- All bids are to be made in accordance with these specifications and Terms & Conditions. Bids which are NOT so made may be rejected as NONRESPONSIVE. |
| 15 | **EXHIBIT 1 – D TERMS AND CONDITIONS**  
Section 1 – Delivery  
Time of delivery is of the essence. Vendor must deliver on time, or all damages suffered by Metra and other costs required to meet the specified delivery schedule will be at Bidder's expense.  
May we include a Force Majeure clause to excuse late delivery beyond Vendor’s control? | No.  
See Bid Submittal Checklist, H. Additional Notes:  
- Bidders are cautioned NOT to qualify their bid by modifying the Contract documents, either by ALTERATION or by SUPPLEMENTAL STATEMENTS.  
- All bids are to be made in accordance with these specifications and Terms & Conditions. Bids which are NOT so made may be rejected as NONRESPONSIVE. |
| 16 | **EXHIBIT 1 – D TERMS AND CONDITIONS**  
Section 4 - Modification  
Metra may make changes in the specifications of this Contract, and Metra will make an equitable adjustment and modify the contract accordingly.  
4. May we include language providing that Metra and Vendor shall agree to the amount of the equitable adjustment? | No.  
See Bid Submittal Checklist, H. Additional Notes:  
- Bidders are cautioned NOT to qualify their bid by modifying the Contract documents, either by ALTERATION or by SUPPLEMENTAL STATEMENTS.  
- All bids are to be made in accordance with these specifications and Terms & Conditions. Bids which are NOT so made may be rejected as NONRESPONSIVE. |
| 17 | **EXHIBIT 1 – D TERMS AND CONDITIONS**  
Section 8 – Termination  
This Contract can be terminated with or without cause, upon seven (7) calendar day’s written notice by Metra.  
May we include language providing that Vendor will be compensated for work in progress and materials ordered to Metra’s specifications? | No.  
See Bid Submittal Checklist, H. Additional Notes:  
- Bidders are cautioned NOT to qualify their bid by modifying the Contract documents, either by ALTERATION or by SUPPLEMENTAL STATEMENTS.  
- All bids are to be made in accordance with these specifications and Terms & Conditions. Bids which are NOT so made may be rejected as NONRESPONSIVE. |
| Page | EXHIBIT 1 – D TERMS AND CONDITIONS  
| Section 15 – Warranties |
|---|---|
| **Materials** will be free from defects in material and workmanship and that all parts furnished will conform to samples, specifications and/or drawings as may be applicable, and will fit for the purpose for which purchased. |
| May we exclude warranty of merchantability, fitness for a particular purpose and other implied warranties and limit remedies for breach of warranty to repair or replacement by Vendor? |
| No. |
| See Bid Submittal Checklist, H. Additional Notes: |
| • Bidders are cautioned NOT to qualify their bid by modifying the Contract documents, either by ALTERATION or by SUPPLEMENTAL STATEMENTS. |
| • All bids are to be made in accordance with these specifications and Terms & Conditions. Bids which are NOT so made may be rejected as NONRESPONSIVE. |
| **No.** |

| Page | EXHIBIT 1 – D TERMS AND CONDITIONS  
| Section 16 – Indemnification |
|---|---|
| **Indemnification** covers injury to all third parties and claims which result from or arise out of the performance of the contract or by the presence of Contractor’s people on premises, even if caused by conditions on the premises owned by Metra. |
| Will Metra accept a dual indemnity provision, with each party accepting liability for its own negligence? May we include a mutual waiver of incidental, consequential and indirect damages? May we limit damages to the PO/contract value? |
| No. |
| See Bid Submittal Checklist, H. Additional Notes: |
| • Bidders are cautioned NOT to qualify their bid by modifying the Contract documents, either by ALTERATION or by SUPPLEMENTAL STATEMENTS. |
| • All bids are to be made in accordance with these specifications and Terms & Conditions. Bids which are NOT so made may be rejected as NONRESPONSIVE. |
| **Protocols are in reference to software, such that future third party systems may integrate with the DVR as effortlessly as possible.** |

<table>
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<tr>
<th>Page</th>
<th>2.3 Hardware is to exhibit the smallest area footprint inside the locomotive and cab cars and use the least mounted hardware as possible. Metra is seeking a modular DVR system, interchangeable, integrate-able with, and replaceable across Metra's cab rolling stock without affecting the other subsystems. The inputs and outputs of the DVR are to exhibit railroad grade connections, and protocols which are non-proprietary and are standard to the railroad industry to the greatest extent possible.</th>
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<tr>
<td>Can Metra provide more details on what is meant by protocols? Is this in reference to hardware or software?</td>
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<tr>
<td>Protocols are in reference to software, such that future third party systems may integrate with the DVR as effortlessly as possible.</td>
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<tr>
<th>Page</th>
<th>3.2.3 There shall be a shared part number for the following subcomponents of the DVR system, such that each subcomponent is interchangeable across all Metra rolling stock. PoE cabling shall be identical in all aspects except for length. Different length PoE cables shall be designated as separate part numbers to the greatest extent possible. Length and further details of the BOM shall be resolved during the FAI.</th>
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<tr>
<td>For the purposes of bidding, assume nominal cable lengths for the purpose of bid. Actual cable lengths will be determined during FAI installation on each different type of rail vehicle.</td>
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<td>• Forward Facing Camera (2) to DVR = 15’ each</td>
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<tr>
<td>• Inward Facing Camera (2) to DVR =</td>
<td></td>
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</tbody>
</table>
Will Metra clarify what cable lengths are required for all installations? At minimum, can “Nominal” cable length estimates be provided for quoting?, as it is unknown what routing path Metra will prefer and the actual cable lengths required.

<table>
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<th>15’ each</th>
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<tr>
<td>Rear Facing Camera – Side Mounted (2) to DVR = 15’ each</td>
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<tr>
<td>Rear Facing Camera – Rear Mounted (Locomotive only) to DVR = 100’</td>
</tr>
<tr>
<td>Bell Microphone to DVR = 25’</td>
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<tr>
<td>Horn Microphone to DVR = 25’</td>
</tr>
<tr>
<td>Cab Audio Microphone to DVR = 15’</td>
</tr>
</tbody>
</table>

See 3.2.3 in revised specification M-17-001 Rev A.

22 3.2.8 The DVR recorder shall have not less than 8 IP video channel inputs.

Would Metra entertain a lower cost configuration incorporating 4 views (Forward, Rear, 2 Inward) as an alternate?

A DVR system with less camera views will not be entertained.

23 3.2.9 The DVR recorder shall have not less than 3 audio channel inputs.

Proposed system will provide one audio input on each camera (ie: a six camera system will provide 6 audio inputs). Note these are not microphones built into the camera but audio inputs on the camera cable that will be connected to a remote microphone. Does this capability meet the requirement?

See 3.3.4.7 in revised specification: M-17-001 Rev A.

24 3.2.18 The DVR shall contain provisions to enable access and perform downloads from the system via ad hoc or peer-to-peer Wi-Fi such that will facilitate Metra in performing DVR data dumps via Wi-Fi at maintenance facilities and outlying points.

3.2.21 The DVR system shall be capable of integrating with other onboard devices and interfaces. The DVR recorder shall have expansion capabilities to satisfy this requirement. An example may be the addition of GPS capabilities, adding wireless capabilities, remote monitoring systems, ability to stream live video through cellular or wireless LAN, ability to upgrade to bigger hard drives, capability to upgrade crash hardened memory, or capability of integrating with alertness monitoring and facial recognition camera technology. In addition, this shall include the ability to add, repurpose, relocate, or change cameras to meet Metra's ongoing needs. During the technical evaluation process, Metra may request information in order to verify expansion capabilities of the DVR system.

For an API to be acceptable, complete documentation shall be provided to Metra, such that a third party can develop a solution to access the video and event recorder storage without requiring the contractor’s future assistance.

See 3.2.18 and 3.8.12 in revised specification: M-17-001 Rev A.
<table>
<thead>
<tr>
<th></th>
<th>Will an API which permits a 3rd party product to access the video and event recorder storage and perform downloads meet the requirements for these sections?</th>
<th>Both 3.2.12 and 3.2.26 are required.</th>
</tr>
</thead>
</table>
|25 | 3.2.26 The DVR system shall have the ability to utilize GPS data for location data and time synchronization.  
3.2.12 indicates time synced to event recorder, 3.2.26 indicates time synced to GPS. Please clarify if either or both methods are required? | The lighting conditions inside the cab vary from direct sunlight to complete darkness. |
|26 | 3.3.2.8 The inward facing cameras shall be suitable for indoor and outdoor installations.  
Could Metra advise why the inward facing cameras need to be suitable for indoor and outdoor use? Typically inward facing cameras are installed within the cab to prevent obstructions and glare. | Before award of the contract, the lowest responsive and responsible Contractor must demonstrate proposed cameras without IR illuminators perform equal to or better than cameras with IR illuminator cameras in 0 Lux. |
|27 | 3.3.2.10 Each inward facing camera shall include an IR (Infrared illumination) feature for night vision video capture capability. No minimum illumination levels are guaranteed inside the cab. The inward facing camera shall be able to use infrared light as illumination for capturing video even in complete darkness (0 Lux).  
Will it be acceptable to omit the IR illuminator if installations at other transit agencies have confirmed acceptable in cab camera operation at night without an IR illuminator? | 3.3.2.12 Each inward facing camera shall have at minimum IP-44 rating. |
|28 | 3.3.4.3 Dedicated microphone shall be capable of recording cab compartment audio. Alternatively, for the purposes of recording cab compartment audio, the microphone may be integrated into the inward facing camera. For this configuration, they shall be shipped disabled. Metra shall be able to enable them at Metra's discretion. This shall not satisfy or apply to sections 3.3.4.1 and 3.3.4.2.  
Since it is an option to utilize the integrated camera mic for cab audio, does this suggest that the inward facing camera does not need to be weather proof? | Metra has no current use for the DIO port. It is anticipated that such a port will be used in the event Metra adopts future technology. |
|29 | 3.5.1.5 The DVR shall feature 1 digital I0 port, at minimum.  
Can Metra provide additional details as to what type of signal is required for the “1 digital I0 |   |
<table>
<thead>
<tr>
<th></th>
<th>30</th>
<th>3.5.4 The entire DVR system shall be capable of normal operation for a wide range of input voltages between 20VDC-80VDC. Normal operations is defined as the DVR system capturing, recording, and storing camera and audio footage onto memory without interruption or faults due to varying input voltage. Additionally, the voltage input requirement to the DVR recorder shall be 20VDC-80VDC. The typical supply range for 74VDC systems is up to 90VDC and not 80VDC. Could Metra advise why 80VDC was selected?</th>
<th>See 3.5.4 and 3.5.16 in revised specification: M-17-001 Rev A.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>31</td>
<td>3.5.10 The visual indicators shall be located on the front of the DVR. Will a separate visual indicator outside of the electrical cabinet also be required for crew visibility?</td>
<td>A separate visual indicator outside of the electrical cabinet is not required</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>3.5.14 The DVR shall feature a USB port to enable firmware upgrades, configuration files, and secure DVR video downloads Would it be acceptable for the firmware and configuration file to be uploaded via the web browser vs. USB, as it is an alternative offering more security.</td>
<td>See 3.5.14 in revised specification: M-17-001 Rev A.</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>3.6.9 The audio/video recorded onto the hard drive shall be encrypted, requiring special hardware/software to successfully retrieve archived audio/video. Will it be acceptable if the video is not encrypted but applies a proprietary format that will not play on any standard windows media player?</td>
<td>Encryption is required per revised section 3.6.9 in specification: M-17001 Rev A.</td>
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<td></td>
<td>34</td>
<td>3.6.10 Separate from the solid state hard drive, a crash hardened memory module shall be priced for use with the DVR system. The crash hardened memory shall be sized to archive 12 hours of video. The DVR shall be already configured to accept crash hardened memory with &quot;plug and play&quot; functionality. The crash hardened memory module shall be a field serviceable component. The crash hardened memory module shall be upgradeable in the future to higher capacities. Crash Hardened Memory Module is internal and</td>
<td>See 3.6.10 in revised specification: M-17-001 Rev A.</td>
</tr>
</tbody>
</table>
| 35 | 3.7.1 The DVR recorder unit, cameras, and hard drive shall meet the following requirements in conformance to AAR Manual of Standards and Recommended Practices, Section K: mechanical shock, vibration, temperature, humidity, and abrasive environment.  
Note that there are a number of requirements within the AAR standard S-5702 that are considered not applicable to the video system (see below). Please advise Metra’s position on this:  
3.2.5 Salt Fog N/A Not required for vehicle interior (non-cab)  
3.2.6 Rain N/A Not required for vehicle interior (non-cab)  
3.2.8 Contaminants N/A Not required for vehicle interior (non-cab)  
3.2.9 Sunlight N/A Not required for vehicle interior (non-cab)  
3.4 Service Life N/A  
5.5 Output voltage current N/A This is for central power supply only  
5.6 Over-Voltage protection N/A This is for central power supply only  
5.7 Short Circuit current N/A This is for central power supply only  
5.8 Voltage Ripple N/A This is for central power supply only  
5.9 Load Regulation N/A This is for central power supply only  
5.10 Voltage Hold-Up N/A This is for central power supply only  
See 3.7.1 in revised specification: M-17-001 Rev A. |
| 36 | 7.2 Up to 80 hours of comprehensive training of the DVR system for Metra's end users to be conducted at Metra facilities, including field locations, as deemed appropriate by Metra. Web based solutions will be considered. Written and electronic copies of the training shall be provided prior to the first production installation.  
This section references that training is “up to” a certain number of hours. Could Metra confirm what the exact number is? Should the vendor assume the maximum number (80hrs)?  
Note that there is no item listed for this training effort within the price sheet, considering the required training may be less than 80hrs, as referenced in our subsequent question below?  
Assume maximum amount of training will be provided. Cost will be priced into the cost of the DVR System Unit. |
<table>
<thead>
<tr>
<th>Section</th>
<th>Question/Comment</th>
<th>Response/Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>37</strong></td>
<td>Could Metra advise how training should be listed in price sheet?</td>
<td>Assume maximum amount of training will be provided. Cost will be priced into the cost of the DVR System Unit.</td>
</tr>
<tr>
<td><strong>37</strong></td>
<td>7.3 Up to 160 hours of comprehensive installation training of Metra employees at the various Metra locomotive shops. Written and electronic copies of the installation instructions shall be provided prior to the first production installation. This section references that training is “up to” a certain number of hours. Could Metra confirm what the exact number is? Should the vendor assume the maximum number (160hrs)? Note that there is no item listed for this training effort within the price sheet, considering the required training may be less that 160hrs, as referenced in our subsequent question below? Could Metra advise how training should be listed in price sheet?</td>
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<td><strong>38</strong></td>
<td>General Comment Regarding Crash Hardened Memory The specification does not describe the video resolution that must be saved in the CHM but only the resolution saved in the disk drive. Can the video saved in the CHM be at a lower resolution / higher compression than that stored in the hard drive?</td>
<td>CHM saved in a lower resolution/higher compression ratio is acceptable provided that it is saved in accordance with FRA 49 CFR Part 229 and the FAST ACT as applicable.</td>
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<tr>
<td><strong>39</strong></td>
<td>Page 1 of the Price List asks for Base fixed pricing per unit. Then the following pages ask for Year 1 and Year 2 Pricing? Can Metra Clarify how many years the Base order will be placed over?</td>
<td>Base Order will be placed all at once. The expectation is that order will be partially fulfilled not later than 120 days after receipt of order.</td>
</tr>
<tr>
<td><strong>40</strong></td>
<td>Price List - Page 1 &amp; of 6 – #4 Asks for DVR accessory Kit per Metra Spec – However it is not understood what components Metra wants in this kit.</td>
<td>See Metra Specification M-17-001 Revision A section 3.6.8.</td>
</tr>
<tr>
<td><strong>41</strong></td>
<td>Price List - On Page 2 &amp; 4 of 6. Line #2 Cab Car it states Estimated Quantity = 0 I think this needs to be 187?</td>
<td>No, the price list is correct. All 187 cab car kits will be ordered in base order.</td>
</tr>
<tr>
<td><strong>42</strong></td>
<td>Page 2 &amp; 4 of 6 – Line #4 Spare kit should include 1 of each below – a. Note Metra is missing the Cable for the Twin View Camera</td>
<td>a. The spare parts price list is not for all spare parts, only the ones listed, as different configurations may differ.</td>
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<td></td>
<td>b. Line #13 it calls for inward Microphone – How should it be handled if the Microphone is part of the inward camera as we are proposing?</td>
<td>b. Then the price would be $0.</td>
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<td>c.</td>
<td>Note Metra is missing a pricing for an inward cable for the microphone.</td>
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<td>c.</td>
<td>The spare parts price list is not for all spare parts, only the ones listed, as different configurations may differ.</td>
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</table>
| 43 | Metra needs to be careful in reviewing pricing for bids as on Page 1 Note #1. In some instances Pricing may not be apples to apples. For instance Metra doesn’t mention Mounting Brackets or hardware on any of their components. Railhead plans to include in our bid. However some companies may exclude this cost in their bid as it is technically not listed or required.  
   a. Brackets would include for the DVR, Cameras (FF, Inward, Side, Rear)  
   43 See section 3.4.3 and 3.4.5 of specification M-17-001 Revision A. |
| 44 | Can Metra provide an editable copy of Exhibit 1-M so we can type out the info making it clearer to input the data?  
   44 No. |
| 45 | In regards to Warranty as stated below – Metra asks that the warranty include Labor? Is this Metra’s Labor force. If that is the case we need to know your labor Rates? Metra would need to advise how they will handle issues and charges, etc?  
   45 No, the warranty labor referenced in Metra specification M-17-001 Revision A, Section 8.13.1 covers only Contractor labor, not Metra labor, that will be used by Contractor to repair and qualify components at the Contractor’s facility. |
| 46 | How will Metra be handling advising the Provider the date of when the unit is installed?  
   46 Date will be based off of maintenance database (Maximo) close of modification work order. Metra will assign warranty POC to work with Contractor to verify installation dates. |
| 47 | How will No defects found be handled – This is an instance when the unit is shipped back and nothing is found to be failed.  
   47 Warranty is to be honored. Metra will work with Contractor to verify proper troubleshooting of system before component replacement.  
   47 Warranty 8.13.1 The warranty period ends 2 years after the unit was installed or 4 years from the shipping date, whichever is earlier. The warranty shall cover the labor and replacement components. All shipping charges associated with the replacement of the defective unit covered by this warranty are the responsibility of the manufacturer. Units that fail shall be repaired in accordance to this specification by the contractor at no cost to Metra. |
All Addendums must be acknowledged on Exhibit 1-O of the Invitation for Bid. Failure to acknowledge Addendums may deem your bid non-responsive. The question period is now closed.

The bid due date remains at the time and place previously advertised.

Sincerely,

James Barker, Department Head
Professional Services & Contracts

JB/jz
Mechanical Department

Digital Video Recording
System for Metra Rolling Stock

SPECIFICATION No. M-17-001

REVISION: A

DATE: 03/03/2017
# RECORD OF REVISIONS

<table>
<thead>
<tr>
<th>REVISION</th>
<th>PREPARED BY</th>
<th>DATE</th>
<th>DESCRIPTION</th>
<th>APPROVED BY</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft</td>
<td>Piotr Jedraszczak</td>
<td>01/05/2017</td>
<td>Draft for internal review</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Ryan Green</td>
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<td>Piotr Jedraszczak</td>
<td>01/12/2017</td>
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<td>1/18/17</td>
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<td>Ryan Green</td>
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<tr>
<td>Revision A</td>
<td>Piotr Jedraszczak</td>
<td>03/03/17</td>
<td>Revised 3.2.3</td>
<td></td>
<td>3/3/17</td>
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<tr>
<td></td>
<td>Ryan Green</td>
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<td>Revised 3.2.18</td>
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<td>Revised 3.2.19</td>
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1. Abbreviations and Definitions

   AAR - American Association of Railroads

   BOM – Bill of Material

   DVR - Digital Video Recorder. Referring to a railroad-grade, cab and locomotive DVR (often abbreviated LDVR outside this specification)

   EMU - Electric Multiple Unit. The rolling stock on Metra's Electric District Lines. Also referred to as a “Highliner”

   FAI - First Article Inspection. Refers to test units and inspection of equipment.


   FPS- Frames Per Second (synonymous with IPS- Images Per Second) of captured, stored, and played back video


   RSAC - Railroad Safety Advisory Committee

2. Objective

2.1 The objective is to implement a DVR system which can be integrated with possible future systems Metra obtains, such as remote monitoring, and/or fatigue detection systems.

2.2 The DVR system will be implemented on Metra’s cab cars, EMUs, and locomotives.

2.3 Hardware is to exhibit the smallest area footprint inside the locomotive and cab cars and use the least mounted hardware as possible. Metra is seeking a modular DVR system, interchangeable, integrate-able with, and replaceable across Metra's cab rolling stock without affecting the other subsystems. The inputs and outputs of the DVR are to exhibit railroad grade connections, and protocols which are non-proprietary and are standard to the railroad industry to the greatest extent possible.

3. DVR (Digital Video Recorder) System

3.1 DVR General Overview

3.1.1 This portion of the specification describes the functional requirements for a Digital Video Recorder system adequate for Metra's rolling stock. The DVR system shall include at a minimum the following major components: Recorder, forward facing camera(s), inward facing cameras, rear facing cameras, microphones, storage memory, and crash hardened memory.
3.1.2 The intent is to specify a technologically updated DVR system from that which Metra currently utilizes and one that has the ability to be easily integrated with any 3rd party remote monitoring system.

3.1.3 The AAR Standards referenced in this section 3 of this specification are based on the latest revision.

3.1.4 The contractor shall comply with all applicable FRA requirements in effect at the time the bids are submitted. In addition the contractor will be required to meet or exceed language contained in the FAST Act Sec. 11411 and RSAC locomotive recording devices working group proposals and recommendations.

3.2 **DVR Recorder General System Requirements**

3.2.1 The DVR system shall be capable of being installed on Metra rolling stock and used to reliably capture and securely archive video for retrieval.

3.2.2 One DVR system shall be designed and configured for use within each of the following categories of Metra rolling stock:

3.2.2.1 Metra’s locomotives (F40PH, F40PHM, MP36PH, F59PH)

3.2.2.2 Metra’s EMUs (including Nippon Sharyo Highliner 1 and Nippon Sharyo Highliner 2)

3.2.2.3 Metra’s Cab Cars (including Nippon Sharyo Gallery Cab Cars and Amerail Gallery Cab cars)

3.2.3 There shall be a shared part number for the following subcomponents of the DVR system, such that each subcomponent is interchangeable across all Metra rolling stock to the greatest extent possible. PoE cabling shall be identical in all aspects except for length. Different length PoE cables shall be designated as separate part numbers to the greatest extent possible. Length and further details of the BOM shall be resolved during the FAI.

3.2.3.1 Forward facing camera- wide view

3.2.3.2 Forward facing camera- narrow view. Separate part numbers are not required for narrow and wide view forward facing cameras if the forward facing cameras are provided in one enclosure

3.2.3.3 Rear facing camera- side mounted

3.2.3.4 Rear facing camera- rear mounted (only used on locomotives)

3.2.3.5 Inward facing camera(s)

3.2.3.6 Microphone(s)

3.2.3.7 Ethernet cable to interface with laptop

3.2.3.8 PoE cabling for forward facing camera

3.2.3.9 PoE cabling for rear facing camera- side mounted
3.2.3.10 PoE cabling for rear facing camera - rear mounted

3.2.3.11 PoE cabling for inward facing camera

3.2.4 The DVR recorder shall be a digital IP (Internet Protocol) based system and support digital IP cameras.

3.2.5 Multiple video and audio input channels shall be available to allow for multiple camera inputs and audio inputs.

3.2.6 The DVR recorder shall accept digital IP Cameras as video channel inputs. The DVR Recorder shall have capability of automatic detection when a camera is plugged into the DVR recorder and automatic configuration of the camera for plug and play functionality.

3.2.7 Plugging in the wrong camera shall in no way adversely affect the configuration of other connected cameras or result in the DVR incorrectly configuring when the correct camera is connected later.

3.2.8 The DVR recorder shall have not less than 8 IP video channel inputs.

3.2.9 The DVR recorder shall have not less than 3 audio channel inputs.

3.2.10 The DVR recorder video channels shall be used to capture and record video from multiple connected cameras simultaneously.

3.2.11 The DVR recorder audio channels shall be used to capture and record bell sounds, horn sounds, and cab compartment audio from multiple connected microphones simultaneously.

3.2.12 The DVR recorder shall feature video motion detection to trigger recording. The video motion detection sensitivity shall be adjustable, customizable, and shall be capable of being enabled or disabled by Metra. Concurrent motion-triggered high-resolution streams and continuously recorded low resolution streams are desirable.

3.2.13 Frame rates and resolutions shall be customizable for each camera. An "off" (no data stored), "low," and "high" setting shall be available and customizable by Metra for each camera. By default the settings shall be equal or greater to:

3.2.13.1 Inward facing cameras- Low: 640x360 at 1 FPS; High: 1280x720 at 10 FPS
3.2.13.2 Rear facing cameras and forward facing cameras: Low: 640x360 at 1 FPS; High: 1280x720 at 30 FPS

3.2.14 The DVR recorder shall feature a pre-event recording buffer allowing the system to record a minimum of 5 minutes of pre-event video after the motion detector activates recording.

3.2.15 The DVR recorder shall feature logging of any alarms or fault statuses that occur. These faults and alarms shall be viewable upon playback

3.2.16 A removable hard drive shall be incorporated into the DVR recorder unit. The removable drive shall have a key lock for security, allowing only authorized personnel to remove the drive.
3.2.17 The DVR recorder shall be capable of simultaneous playback, remote access, and recording. A laptop shall be capable of connecting to the DVR recorder through an Ethernet cable using a network connection using a TCP/IP connection with IP address.

3.2.18 The DVR shall contain built-in Wi-Fi hardware or the contractor shall supply an external accompanied railroad grade access point to enable access and perform downloads from the system via ad hoc or peer-to-peer Wi-Fi such that will facilitate Metra in performing DVR data dumps via Wi-Fi at maintenance facilities and outlying points. Metra shall retain the ability to enable or disable the Wi-Fi capability features on the DVR system.

3.2.19 The DVR recorder shall be adhere to Vehicle Interior Cab requirements of AAR S-9401.

3.2.20 The lifecycle of the DVR system shall be a minimum of 5 years.

3.2.21 The DVR system shall be capable of integrating with other onboard devices and interfaces. The DVR recorder shall have expansion capabilities to satisfy this requirement. An example may be the addition of GPS capabilities, adding wireless capabilities, remote monitoring systems, ability to stream live video through cellular or wireless LAN, ability to upgrade to bigger hard drives, capability to upgrade crash hardened memory, or capability of integrating with alertness monitoring and facial recognition camera technology. In addition, this shall include the ability to add, repurpose, relocate, or change cameras to meet Metra’s ongoing needs. During the technical evaluation process, Metra may request information in order to verify expansion capabilities of the DVR system.

3.2.22 The contractor shall enable security measures to prohibit unauthorized DVR downloads.

3.2.23 On the video playback, The DVR system shall display a time and date stamp on all downloaded data. The time shall be synchronized with the time clock used by the event recorder.

3.2.24 The DVR shall interface, access and download existing event recorder data. It is the responsibility of the contractor to possess the skill and technical expertise with the associated protocols and means of interfacing to the event recorder system. On the playback software, the system shall display event recorder data concurrent with video downloads. A minimum number of 4 event recorder channels shall be recorded: speed (SPD), Brake Pipe Pressure (BPP), Brake Cylinder Pressure (BCP), and Throttle (THR).

3.2.25 Metra currently operates the following event recorder models: Bach-Simpson Models 54300-01, 54300-04, and 54300-11.

3.2.26 The DVR system shall have the ability to utilize GPS data for location data and time synchronization.

3.2.27 The DVR system shall record for a minimum of one hour after the train has ceased movement.

3.3 Camera and Microphone Hardware Requirements
3.3.1 **Forward Facing Cameras**

3.3.1.1 A minimum of one camera with two lenses shall be “forward facing.” The camera shall be installed at the front end of the locomotive. The forward facing camera shall be used to record the right of way, incidents, and railroad signal aspects of wayside signals. The cameras shall be aimed parallel to the centerline of tangent track within the gauge.

3.3.1.2 The forward facing camera shall be capable of clearly recording railroad signal aspects in all types of weather, day, or nighttime conditions with normal nighttime illumination from the headlight and auxiliary lights of the locomotive/cab car/EMU. The railroad signal aspects (colors) shall be clearly discernible during DVR video playback.

3.3.1.3 Each forward facing camera shall be adjustable to allow for camera positioning.

3.3.1.4 Each forward facing camera shall be a high definition digital IP type camera.

3.3.1.5 Each forward facing camera shall be powered by PoE (Power over Ethernet). Metra shall require M12 Ethernet connector for all Ethernet communication.

3.3.1.6 Each forward facing camera shall be capable of recording color.

3.3.1.7 The forward facing camera shall feature a dual lens. Or 2 standalone cameras can be used. One camera lens shall capture wide view, and one camera lens shall capture narrow view.

3.3.1.8 Each forward facing camera shall be housed in tamperproof camera housing.

3.3.1.9 Each forward facing camera housing shall be resistant to dirt, dust, and moisture.

3.3.1.10 Each forward facing camera shall have a minimum IP (Ingress Protection) rating of IP-66.

3.3.2 **Inward Facing Camera**

3.3.2.1 Two (2) cameras shall be “inward facing” and used to record the cabin compartment operator area and control stand of a locomotive or the cab of a control car.

3.3.2.2 Each inward facing camera shall be adjustable to allow for camera positioning.

3.3.2.3 Each inward facing camera shall be a high definition digital IP type camera.

3.3.2.4 Each inward facing camera shall be powered by PoE (Power over Ethernet). Metra shall require M12 Ethernet connector for all Ethernet communication.

3.3.2.5 The inward facing cameras shall be capable of recording black and white,
as well as color. The settings shall be made accessible and adjustable to Metra.

3.3.2.6 Each inward facing camera shall have 1 lens.

3.3.2.7 Each inward facing camera shall be housed in a compact vandal resistant enclosure.

3.3.2.8 The inward facing cameras shall be suitable for indoor and outdoor installations.

3.3.2.9 The inward facing cameras shall be capable of recording in any weather, day, or nighttime conditions.

3.3.2.10 Each inward facing camera shall include an IR (Infrared illumination) feature for night vision video capture capability. No minimum illumination levels are guaranteed inside the cab. The inward facing camera shall be able to use infrared light as illumination for capturing video even in complete darkness (0 Lux).

3.3.2.11 Each inward facing camera shall be resistant to dirt, dust, and moisture.

3.3.2.12 Each inward facing camera shall have at minimum IP-44 rating.

3.3.3 Rear Facing Cameras

3.3.3.1 A minimum of 2 cameras with 1 lens each shall be “rear facing” and used to record the right of way, incidents, and railroad signal aspects in the rear view. One camera each side shall be located on the engineer’s side and fireman's/conductor's side on the rear of the cab on cab cars and highliners. Rear facing cameras as previously described will be located at the rear of the carbody on locomotives. In addition, on locomotives only, a third rear-facing camera shall be installed in the rear of the locomotive by the top headlight. The rear-mounted camera shall be used with the objective to record when the locomotive is operating with the rear in the forward direction of movement and the cab compartment facing the reverse direction of movement.

3.3.3.2 Each rear facing camera shall be adjustable to allow for camera positioning.

3.3.3.3 Each rear facing camera shall be a high definition digital IP type camera.

3.3.3.4 Each rear facing camera shall be powered by PoE (Power over Ethernet). Metra shall require M12 Ethernet connector for all Ethernet communication.

3.3.3.5 The rear facing cameras shall be capable of recording black and white, as well as color. The settings shall be made accessible and adjustable to Metra.

3.3.3.6 Each rear facing camera shall be housed in a compact vandal resistant enclosure.

3.3.3.7 The rear facing cameras shall be suitable for indoor and outdoor installations.
3.3.3.8 The rear facing cameras shall be capable of recording in any weather, day, or nighttime conditions.

3.3.3.9 Each rear facing camera enclosure shall be resistant to dirt, dust, moisture, and car wash cleaning solutions.

3.3.3.10 Each rear facing camera shall have at minimum IP 66 rating.

3.3.4 **Microphone**

3.3.4.1 One (1) dedicated microphone shall be capable of recording horn sounds.

3.3.4.2 One (1) dedicated microphone shall be capable of recording bell sounds.

3.3.4.3 Dedicated microphone shall be capable of recording cab compartment audio. Alternatively, for the purposes of recording cab compartment audio, the microphone may be integrated into the inward facing camera. For this configuration, they shall be shipped disabled. Metra shall be able to enable them at Metra’s discretion. This shall not satisfy or apply to sections 3.3.4.1 and 3.3.4.2.

3.3.4.4 Each microphone shall be resistant to dirt, dust, and moisture.

3.3.4.5 Each microphone shall be rated for exterior outdoor use.

3.3.4.6 Each microphone may be housed in a NEMA weatherproof enclosure to satisfy the requirements outlined in this section.

3.3.4.7 Any audio capturing device within any supplied camera or camera wiring cannot be used to fulfill requirements of 3.3.4.1 and/or 3.3.4.2.

### 3.4 **DVR System Mechanical Hardware Requirements**

3.4.1 The mechanical footprint of the DVR recorder unit, associated cameras, cabling, and other devices shall conform to existing space available on Metra rolling stock subject to the requirements listed in this section.

3.4.2 All permanent connections to the DVR unit shall be mil spec MIL-C-26482 twist cannon plug type or equivalent. Ethernet connections shall be M12 industrial Ethernet or equivalent

3.4.3 All mounting brackets, plates, mounting hardware, and miscellaneous materials necessary for the proper installation and setup of the cameras and DVR recorder shall be supplied. All brackets, plates, and mounting hardware shall be designed in accordance to Locomotive Electronics System Architecture AAR Standard S-9101.

3.4.4 Specific cable lengths, bracket dimensions, and plate dimensions shall follow AAR Standard S-9101 for use on Metra rolling stock.

3.4.5 Each camera shall include adjustable mounting hardware such that the height, direction, orientation, and angle in all 3 axes X/Y/Z as applicable of each camera’s captured view is adjustable. The hardware shall include the ability to lock all adjustments made. Metra shall have the ability to unlock and readjust the

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camera. Metra field personnel shall be capable of performing all camera adjustments as necessary and without the contractor's assistance. The design shall be subject to Metra approval.

3.5 **DVR System Electrical Hardware Requirements**

3.5.1 The Contractor shall supply all necessary Ethernet cables, camera cables, power cables, and audio cables necessary.

3.5.2 The Contractor shall supply all hardware for interface to existing equipment.

3.5.3 All interconnect wires including Ethernet cables shall meet 49 CFR 238.103 and NFPA 130 requirements. All cables including Ethernet cables shall be Polyolefin jacketed and shielded if applicable. All interconnect wires shall meet flame, toxicity, and low smoke requirements.

3.5.4 The entire DVR system shall be capable of normal operation for a wide range of input voltages between 20VDC-80VDC. Normal operations is defined as the DVR system capturing, recording, and storing camera and audio footage onto long term storage memory without interruption or faults due to varying input voltage within the prescribed voltage range. Additionally, the voltage input requirement to the DVR recorder and any other device requiring locomotive, EMU, or cab car power connections shall be 20VDC-80VDC. Operating voltages above the maximum operating voltage and below the required operating voltage are acceptable provided that the specified operating range is maintained.

3.5.5 No external power supply shall be required in order to power the DVR recorder. All power supplies shall be internal to the DVR recorder unit.

3.5.6 The DVR recorder shall be capable of normal recording operations during momentary power losses, defined as 1 second or less, without: sustaining data loss, causing the DVR to reset due to momentary power loss, recording failure due to momentary power loss, or the DVR recorder entering a fault state requiring maintenance due to momentary power loss.

3.5.7 During extended power loss, the backup power source shall continue to power the DVR recorder for sufficient length of time to allow the DVR recorder to gracefully shutdown without sustaining data loss.

3.5.8 The DVR recorder shall have user adjustable resolution and FPS settings. The settings shall be made accessible to Metra. The settings shall be adjustable for each individual camera connected to the DVR.

3.5.9 The DVR recorder shall have a "self-test" and visual indicator system that indicates the system is properly functioning and recording. The visual indicator system shall alert personnel upon failure of any camera, hard drive, or other type of fault.

3.5.10 The visual indicators shall be located on the front of the DVR.

3.5.11 The DVR recorder shall feature an Ethernet interface to enable for a direct computer connection.

3.5.12 A computer shall be capable of connecting directly to the DVR recorder through
an Ethernet interface for onboard video downloads without removal of the hard drive.

3.5.13 The DVR system shall not use or interfere with any existing PTC infrastructure.

3.5.14 The DVR shall be capable of firmware upgrades, configuration files, and secure DVR video downloads through an Ethernet connection, ad hoc Wi-Fi, or USB port.

3.5.15 The DVR shall feature 1 digital IO port, at minimum.

3.5.16 The DVR shall have overvoltage and transient protection for input voltages above 80 VDC.

### 3.6 Storage Memory Requirements

3.6.1 The hard drive shall be solid state with a capacity not less than 1TB.

3.6.2 The hard drive shall be industrial grade and be rated for video/audio recording purposes.

3.6.3 The hard drive capacity shall be sized to archive not less than 10 days of video.

3.6.4 The hard drive shall be upgradeable in the future to higher capacities.

3.6.5 The video archive is desired to be 10 calendar days. The 10 calendar day video archive shall be based on worst case operating conditions with the forward facing dual camera and both inward facing cameras recording simultaneously and continuously. Each forward facing camera shall record at a rate of not less than 24 frames per second and have sufficient resolution to record the position of switch points 100 feet in front of the locomotive/cab car/EMU or a minimum resolution of 1280x720, whichever resolution is higher. Each inward facing camera minimum resolution quality and frame rate shall be 15 frames per second with a resolution of 1280x720.

3.6.6 The hard drive shall be removable from the DVR recorder by authorized personnel with a key.

3.6.7 The ability to retrieve video and audio data from a removed hard drive on a workstation located at a remote location shall be required.

3.6.8 Any required hard drive adapters, docking station, associated cables, and power adapters required to interface the removed hard drive with a computer shall be assembled into an accessory kit available for purchase by Metra. Contractor shall provide a price on line item 4 of the price list.

3.6.9 The DVR system shall feature a robust and secure encryption scheme to protect all information recorded and stored onto the hard drive or crash hardened memory storage media. The audio/video recorded onto the hard drive shall require a special hardware/software to successfully retrieve archived audio/video.

3.6.10 In addition to the solid state hard drive storage media, a separate crash hardened memory module shall be priced for use with the DVR system. The crash hardened memory module may be internal or external. The crash hardened memory module
hardened memory shall be sized to archive 12 hours of video. The DVR shall be already configured to accept crash hardened memory with “plug and play” functionality. The crash hardened memory module shall be a field replaceable component by Metra personnel without requiring the assistance of the contractor. The crash hardened memory module shall be upgradeable in the future to higher capacities.

3.6.11 Crash hardened memory module supplied shall be DOT certified to FRA 49 CFR Part 229.

3.6.12 The solid state hard drive shall be mechanically and functionally uniform and interchangeable across all DVR systems defined in this specification.

3.6.13 The crash hardened memory module shall be mechanically and functionally uniform and interchangeable across all DVR systems defined in this specification.

3.7 **DVR System Environmental Requirements**

3.7.1 The DVR recorder unit, cameras, hard drive storage media, switches/routers, and any other electronic component supplied as part of the DVR system shall meet the requirements in conformance to AAR Manual of Standards and Recommended Practices AAR S-9401, Table 3.1. The “Vehicle Interior Cab” category shall apply to all components of the DVR system installed inside the cab or adjacent interior area near the cab. The “Vehicle Exterior Body Mounted” category shall apply to all components of the DVR system installed on the exterior of the locomotive/cab car/EMU, including rear facing cameras.

3.7.2 The DVR recorder, cameras, solid state hard drive storage, switches and any other supporting DVR system components supplied to Metra shall be capable of operating in worst case temperature extremes in accordance with temperature standards listed in AAR Manual of Standards and Recommended Practices, Section K.

3.7.3 The DVR recorder shall not require external heating or cooling to maintain nominal operation over the expected temperature conditions inside a locomotive.

3.8 **DVR System Software Requirements**

3.8.1 The DVR system shall include computer software that allows for downloading and onboard viewing of video directly from the DVR recorder without removing the hard drive.

3.8.2 The software shall allow the user to specify specific dates and times in order to control the length of the video clips downloaded.

3.8.3 When downloading a video/audio clip, the user shall have the ability to select or deselect which video and audio channels are to be downloaded.

3.8.4 The software shall have the capability to export all video and audio channels (including dedicated audio channels) into 1 file with all video and audio channels synchronized.
3.8.5 Each audio/video clip shall contain at minimum a time stamp with date, time, name of DVR system, and associated video channel names that are overlaid onto the image and synchronized with video and audio.

3.8.6 Upon starting the software, the main screen shall automatically (and without user interaction) display in real time live video viewports of all the cameras simultaneously. The viewports of all the video channels shall be visible simultaneously and without obstructions to the user on the main screen. The user shall not be required to make any clicks, minimize or maximize windows to cycle through to view video camera channels. The software interface design shall be subject to Metra approval.

3.8.7 The DVR system shall include computer software allowing for video downloads for a hard drive removed from the DVR recorder that is connected to a laptop or desktop computer. The software interface design shall be subject to Metra approval.

3.8.8 All computer software supplied to Metra by the Contractor shall include an unlimited use license agreement for unlimited installations and use. The ability for Metra personnel to install and configure all supplied software without contractor assistance or interaction shall be required.

3.8.9 Future software updates to any computer software shall be provided free of charge to Metra for the duration of the contract.

3.8.10 The Contractor shall supply Metra with all computer software archived on electronic media. The software shall be archived along with the DVR documentation described in Section 4.

3.8.11 The operating system requirements for all computer software supplied to Metra by the Contractor shall be Windows XP/7/8/10 compatible.

3.8.12 Any API provided to satisfy 3.2.18 and/or 3.2.21 shall be accompanied by complete documentation, provided to Metra, such that a third party can develop a solution to access the video and event recorder storage without requiring the contractor’s future assistance.

3.8.13 Any software supplied shall have the ability to be configurable to meet the requirements outlined in this section. Metra shall have the ability to reconfigure the software as needs change and shall not be locked into the requirements as defined in this section.

4. **DVR System Documentation**

4.1 Each DVR recorder shall arrive with its own unique means of identification located on the unit itself. The information shall include at a minimum: serial number, date of assembly, manufacturer name, and part number.

4.2 All major components shall be clearly labeled with a part number, product name, and serial number.

4.3 It is the responsibility of the Contractor to design detailed mechanical drawings to
accommodate the desired mechanical footprint. All mechanical drawings shall be submitted for approval by Metra personnel before the delivery of the first production unit.

4.4 The Contractor shall use DVD as the preferred electronic media for submission of final documentation to Metra. Final documentation shall be submitted to Metra prior to delivery of the first production unit.

4.5 All documents that are archived on electronic media shall be in pdf (Portable Document Format) format.

4.6 Detailed mechanical drawings for each individual component of the DVR system shall be submitted to Metra to satisfy part of the documentation requirements, and shall be submitted prior to delivery of the first production unit.

4.7 Detailed electrical specification datasheets for each individual electrical component shall be submitted to Metra to satisfy part of the documentation requirements, and shall be submitted prior to delivery of the first production unit.

4.8 A user manual shall be submitted to Metra to satisfy part of the documentation requirements, and shall be submitted prior to delivery of the first production unit.

4.9 A maintenance manual shall be submitted to Metra to satisfy part of the documentation requirements, and shall be submitted prior to delivery of the first production unit.

4.10 A complete bill of material shall be submitted to Metra to satisfy part of the documentation requirements, and shall be submitted prior to delivery of the first production unit.

4.11 The Contractor shall archive all software and all documentation together onto 1 DVD. 10 DVD copies shall be submitted to Metra to satisfy part of the documentation requirements.

4.12 A detailed troubleshooting manual with step by step instructions intended for electricians working in the field shall be submitted to Metra to satisfy part of the documentation requirements, and shall be submitted to Metra prior to delivery of the first production unit.

4.13 The Contractor shall make available to Metra on DVD or other agreeable multimedia platform step by step video tutorials on how to configure the DVR and camera settings, perform a DVR download, DVR troubleshooting step by step, and step by step installation and configuration of the PC based DVR software.

5. Testing

5.1 FAI units produced shall be subject to additional testing requirements. All tests performed on the FAI units shall be conducted while the DVR is operational and recording audio and video unless otherwise noted. A report of each test and accompanied results shall serve as proof of satisfying testing requirements defined in this section as well as satisfying environmental requirements defined in section 3.7. Upon Metra’s request, contractor shall submit test results for testing to conformance to AAR, IEC, FCC, and EN standards.
specifically referenced in this specification.

5.2 Each FAI DVR system with all cameras and microphones connected and operational shall be tested by supplying 20VDC to the DVR system voltage input to verify nominal video and audio recording operations. Any external POE switches or other supporting equipment powered externally from the DVR recorder shall also be subject to 20VDC input voltage. The test shall be no less than 30 minutes in duration. A video download with audio of the 30 minute test shall be completed and submitted to Metra. Each FAI unit shall be retested by supplying 80V to the DVR system voltage input to verify nominal recording operation. Again, any external POE switches or other supporting equipment powered externally from the DVR shall also be subject to 80VDC input voltage. The test shall be no less than 30 minutes in duration. A video download with audio of the 30 minute test shall be completed and submitted to Metra.

5.3 At Metra’s request, the contractor shall be required to submit qualified third party test results for the IP (Ingress Protection) rating of all cameras supplied.

5.4 DVR software to perform downloads shall be included as a line item in the FAI and subject to Metra approval. Metra shall require the DVR system computer software (used to perform downloads by the user) be tested at the FAI according to the requirements outlined in section 3.8 of this specification. For non-compliant requirements as determined by Metra during the FAI, Metra reserves the right to require the contractor to redesign the software in order to comply with requirements established in section 3.8.

5.5 All test results completed for the FAI unit shall be submitted to Metra for approval prior to delivery of production units.

5.6 Each production or FAI unit produced shall be tested for all basic functions defined in this specification. This shall include at a minimum:

5.6.1 Verification that all DVR settings and configuration are exactly the same settings as the FAI unit approved by Metra.

5.6.2 DVR power up test.

5.6.3 DVR abrupt power loss and shutdown test (to verify that the backup power source can provide enough backup power allowing the DVR recorder to gracefully shutdown without suffering failure).

5.6.4 60 seconds of video capture and immediately thereafter a video download directly from the DVR of the recorded 60 seconds.

5.6.5 Verification of fault status indicator functionality for each video channel (disconnection of the camera to verify status indicator changes to fault status).

5.6.6 Other tests agreed upon by the Contractor and Metra.

5.7 Results of all tests conducted for each production unit shall be successful before shipping to Metra.

5.8 Results of all tests conducted for each production unit shall be packaged along with each DVR shipped to Metra.
6. DVR System Deliverables

6.1 The contractor shall provide all hardware, software, and documentation that comprise the complete DVR system. An FAI (First Article of Inspection) and Metra approval shall be required for the hardware, software and documentation.

6.2 A First Article of Inspection shall be conducted and completed. 5 complete DVR systems produced along with a copy of the DVR computer software to perform downloads shall be designated the prototype or FAI (First Article of Inspection) units, unless otherwise noted by Metra. The FAI units will be tested for a specified period of 90 days after installation at Metra on various rolling stock. Metra reserves the right to extend the FAI test period an additional 90 days. An FAI may be conducted at the Contractors facility. The type of FAI chosen will be determined by Metra. Any deficiencies identified by Metra during testing or during review of test results shall be resolved to Metra’s satisfaction. It shall be the contractor’s responsibility to make adjustments, corrections, or supply additional components to the DVR system in order to comply with Metra's specification at no extra cost to Metra. Until the FAI unit and FAI test results have been accepted by Metra, Metra shall not accept production units. The Contractor assumes the risk of manufacturing production units before acceptance of the FAI unit by Metra. Metra reserves the right to waive or make changes to the FAI process.

6.3 Each FAI unit produced shall be selected and tested according to section “Testing” to verify the DVR system conforms to environmental operating requirements. In order for any test results to be considered valid by Metra, there shall be no modifications made to any components previously tested for compliance to IEC Standards, APTA Standards, AAR Standards, NFPA 130 Standards, EN Standards, FCC Standards, FRA regulations, or any other applicable standards. If any component is changed, modified, or altered to meet the requirements specified in this specification, any prior testing conducted may be considered invalid and the test results rejected by Metra. At Metra’s sole discretion and at the contractor’s expense, Metra shall require additional testing for any individual components to standards outlined in this specification and other applicable standards as determined by Metra. Metra shall have the sole right to determine the tests that are required and the test results that are acceptable. Metra shall be notified if any changes are planned or implemented.

6.4 Ongoing support of Contractor’s provided hardware and software systems throughout the warranty period shall be provided. Software bug fixes and updates shall be provided free of charge to Metra for the duration of the contract.

6.5 Complete documentation of all provided products in both printed and electronic form according to the requirements in this specification.

6.6 Normal business and after hours technical support of the system as required by Metra.

6.7 Metra Requirements:

6.7.1 Metra will supply computer terminals, laptops and monitors. All software shall be compatible with Windows 7/8/8.1/10.

6.7.2 Metra workforces will install the prototype and production systems at no cost to the Contractor.

6.8 Training as specified in Section 7
7. **Technical Support/Training**

7.1 During the duration of the contract the Contractor shall provide high quality and responsive technical support to Metra. The contractor shall designate a technician to provide onsite and over the phone technical support at no extra cost. Technical support shall be made available at Metra’s request. Onsite support shall include all of Metra’s train yard locations and maintenance facilities. The contractor shall respond to all requests and initiate corrective action within 24 hours. All costs associated with technical support for the duration of the contract shall be borne by the contractor.

7.2 Up to 80 hours of comprehensive training of the DVR system for Metra’s end users to be conducted at Metra facilities, including field locations, as deemed appropriate by Metra. Web based solutions will be considered. Written and electronic copies of the training shall be provided prior to the first production installation.

7.3 Up to 160 hours of comprehensive installation training of Metra employees at the various Metra locomotive shops. Written and electronic copies of the installation instructions shall be provided prior to the first production installation.

7.4 Metra shall have the option to roll any unused installation training hours from section 7.3 into 7.2 or unused hours from section 7.2 into 7.3, respectively, at no extra cost to Metra.

8. **Quality Assurance**

8.1 All bidders must submit a copy of the manufacturer’s quality assurance manual and associated quality plans and procedures to Metra for review. Metra shall be the sole judge of compliance to the appropriate quality assurance standards.

8.2 The quality assurance manual will be consistent with the scope and procedures described in the current Association of American Railroads Manual of Standards and Recommended Practices, Section J, Specification for Quality Assurance M-1003.

8.3 Upon review by Metra, any deviation or deficiencies in the quality assurance documents provided by the bidder may render the bid non-responsive.

8.4 Metra’s authorized representative(s) shall have, at all reasonable times, access to the Contractor’s facility for the purpose of inspecting materials, workmanship, quality, and compliance to this specification. Refusal to permit such inspection may be construed as non-compliance with Metra’s specification and risks in cancellation of the bid.

8.5 Submission of a bid gives Metra the authority to inspect the bidder’s facilities in order to perform a quality audit(s). Audit(s) shall be scheduled no later than 14 days from Metra’s notice to perform the audit.

8.5.1 Metra may inspect tooling, procedure manuals, training programs, worker certification records, test gauges, inspection procedures, and subcontractor qualifications.

8.5.2 The audit will be styled after and include the items described in AAR Specification M-1003.
8.5.3 Metra requires authorization to take pictures of Metra product(s) in the contractor's facilities.

8.5.4 If upon inspection by Metra it is determined that shop practices are deficient, the bid may be rendered non-responsive. Examples of shop practices include at a minimum but not limited to: employee training practices and equipment maintenance practices.

8.6 Prior to the award of a contract, and within 48 hours of the request, the successful bidder is to provide the following facility information:

8.6.1 The ration of Inspection to Production Personnel

8.6.2 Total QA/QC Personnel

8.6.3 Shop Address, Name, Email, and Phone Number of the Shop Manager

8.6.4 List of any subcontractor names, addresses, contact information and their qualifications. In case that the bidder uses subcontractors, the bidder shall provide the name of the subcontractors and the bidder’s quality assurance plan (described in section 3.1) shall describe how to manage subcontractor’s quality and delivery.

8.7 The bidder shall correct all deficiencies, as determined by Metra. Failure to correct such deficiencies or repetitive notations of deficiencies may be cause for cancellation of the contract.

8.8 Only substitutions equal (or better in comparison) to the specified items will be subject for approval by Metra’s Chief Mechanical officer and only when such substitution is absolutely necessary (as determined by). Before furnishing and/or installing any product that is a substitute for the specified item, proof of equality and quality shall be furnished by the contractor. Then the written approval of Metra’s Chief Mechanical Officer must be obtained before any such decision is made.

8.9 The presence of Metra’s representative(s) at the contractor’s facility shall not in any manner supplant the contractor’s own inspection, nor lessen the responsibility to meet all requirements of this specification. Metra shall have the right to reject all material and workmanship that does not conform to this specification or accepted practices.

8.10 As part of their contractual requirements to Metra, the Contractor will be responsible for the quality assurance and quality control of the drawings, CAD files and other documents submitted to Metra as part of the contract. The Contractor shall ensure compliance to this document, Metra project specifications, applicable Metra quality management plans, and other contractually required documents. Metra’s review of the submittals shall not be construed as relieving or mitigating the Contractor of this responsibility.

8.11 **First Article Inspection (FAI)**

8.11.1 Unless specifically waived by Metra, First Article Inspections (FAI) will be required and performed either at the Contractor’s facility or on Metra property by Metra’s authorized representative(s). After engineering concerns have been agreed upon, the Contractor will provide Metra with a fully functional prototype of each product for the FAI.
8.11.2 The FAI will be performed to determine if the product(s) meet the minimum requirements specified in the contract documents.

8.11.3 If the product(s) is/are found not to meet the minimum requirements, then the Contractor must work to correct the exceptions to the satisfaction of Metra. Once the prototype has been found satisfactory, then (and only then) can the Contractor commence shipment of the entire order.

8.11.4 **The Contractor will be required to prepare:**

8.11.4.1 Documentation Requirements prior to the FAI:

- Quality Plan
- FAI Procedure that should contain:
  - FAI Agenda (Including FAI location and date)
  - Item list of items presented with drawing number & revision
- FAI Plan
  - Presenting Item list with drawing & revision
  - Visual Inspection Plan & Criteria
  - Dimensional Inspection Plan & Criteria
  - Functional Inspection & Criteria
  - Inspection Forms (Blank) and Check List
  - Test Procedure & Criteria
- FAI procedure and Quality Plan must be approved or conditionally approved by Metra prior to the FAI.

8.11.5 **Minimum Requirements At FAI:**

- Metra will review the hardware, software, documentation and may witness any tests required.
- Metra requires authorization to take pictures of FAI products in the Contractor’s facilities.
- The contractor should prepare the FAI book (1 paper copy and 1 electronic format in PDF file in CD or USB) and provide Metra at FAI.
- FAI Book shall contain:
  - All Drawings & drawing list with revision
  - A copy of PO without prices
  - List of subcontractors if used
  - Inspection Reports with marked drawing
  - Weight of each product
  - Test Reports (If Metra witnesses the test, provide the test report at FAI or later)
  - Detailed photographs of each product
  - Material Certifications
  - Fire Safety/Flammability Reports as required by 49 CFR 238.103
  - Welding Certification (A copy of WPS, PQR, Welder and Welding Operator Performance Qualification Record, AWS Certified Welder’s name and certification number)
  - Qualification Test Report (as required)
  - Calibration Record
  - Other items as determined by Metra

8.11.6 **FAI Follow up**

- Any open issue/documentation will need to be closed.
- A Re-FAI may be scheduled as determined by Metra.

8.12 **Item Identification And Traceability**

8.12.1 Each item shall arrive with its own unique means of identification located on the unit itself. The information shall include at a minimum serial number, manufacturer name, and part number.

8.12.2 It is the responsibility of the vendor to design detailed mechanical drawings to accommodate the desired mechanical footprint. All mechanical drawings shall be submitted for approval by Metra personnel.

8.12.3 The vendor shall supply Metra with adequate operating and service instructions, which can be duplicated by Metra for placement in the associated car service manuals. The contractor shall provide an illustrated parts list of field replaceable components (if any). All documentation will need to be approved by Metra for this requirement to be satisfied.

8.12.4 All drawings and documents submitted to Metra by the vendor shall become the property of Metra.

8.13 **Warranty**

8.13.1 The warranty period ends 2 years after the unit was installed or 4 years from the shipping date, whichever is earlier. The warranty shall cover the labor and replacement components. All shipping charges associated with the replacement of the defective unit covered by this warranty are the responsibility of the manufacturer. Units that fail shall be repaired in accordance to this specification by the contractor at no cost to Metra.

8.13.2 Should at least two out of ten delivered units experience a consistent type of failure (due to component failure or otherwise), the contractor has 24 hours to respond with a solution or begin working toward a solution. If no resources are made available or the solution is not to Metra’s satisfaction, the contractor risks being placed in “breach of contract.”
Locomotive 108 – F40PH-3
Locomotive 204 – F40PHM-2