

## EM hardware, software, and support elements

### Necessary for integration with Alaska's 2017 fixed gear EM program design.

**Introduction:** The management objective for the 2017 EM program for longline and pot vessels is to estimate discards by documenting species composition and disposition (fate) of catch. For longline vessels, validating the presence/absence of seabird mitigation devices (streamer lines) when setting gear is also a management objective. The 2017 EM program will be based on current EM technologies with video and sensor data reviewed by human reviews.

The purpose of the document is to describe functional requirements for EM hardware, software, and support services necessary to integrate with the 2017 EM program design. The intent is to also capture lessons learned through field work, identify methods and features which have demonstrated the ability to provide necessary data, and provide a reference point for evaluating the capabilities of future EM hardware and services. It is not intended to limit innovation. This document is envisioned to be updated annually as pilot testing of new approaches provides additional information, and to reflect the evolution of management objectives, EM technologies, and program design over time.

#### EM Hardware:

- **Overall**—All components of the EM system must be:
  - Able to withstand a marine environment.
  - Capable of accommodating vessel input power voltages from 10V – 32V DC and 110V AC.
  - Capable of accommodating reasonable variations in power quality common to small fishing vessels.
  - Utilize an uninterruptible power supply (UPS) or other system to allow data to continually be logged during short power fluctuations or temporary brown outs in order to minimize data loss.
  - Designed so the vessel's power state (engines or generators on/off) govern the EM system's power state to prevent draining vessel batteries. EM systems may power down to minimize battery drain when the main engine is off, but should automatically re-start when engine activity resumes.
  - Designed for a bridge environment to standards that minimize radio frequency interference with other electronics and instrumentation. (e.g. BS EN 60945);
- **Control Center**-- The control center should be an independent, fully enclosed, device containing the operating software and data storage components of the EM System. It must be:
  - Capable of receiving and processing digital video inputs from a sufficient number of cameras to fully support species identification and fate determination of catch (longline and pot gear vessels); and determine presence/absence of seabird deterrent devices the wake area when setting gear

(longline vessels only). Typically this requires three to four cameras on vessels fishing longline gear and two cameras on vessels fishing pot gear.

- o Capable of receiving and recording the following sensor data elements based on a configurable interval (typically 10 seconds):
  - Vessel position and speed from GPS
  - Hydraulic pressure
  - Deck equipment rotation (longline only)
- o Contain a hard drive for data storage capable of being easily removed/replaced by the vessel operator and mailed in for EM review. Hard drives should have sufficient capacity to store approximately 1 month of fishing activity (typically 1 TB);
- o Have “quick disconnect” connections to allow easy removal and installation on multiple vessels/yr. (longline vessels only)
- **Video Monitor**—A compact video monitor, powered by the control center, capable of displaying video images to allow vessel operators to evaluate system operation, (recording vs. not recording), system health, and video image quality in order to conduct maintenance as needed.
- **Rail Camera(s) (longline vessels only)**—Digital camera(s) housed in a waterproof (minimum IP66 rating,) low profile fixture, capable of providing color images of the hauling and discard areas at sufficient resolution and frame rate to support species identification and fate determination (typically 5 -10 FPS). Rail camera(s) are activated only during hauling events to avoid constant recording. The rail camera field of view (FOV) must monitor the entire area from where catch breaks the surface of the water to where it is brought onboard the vessel. Previous experienced has identified a 20 degree outboard view angle of the hauling station as an optimal camera view.
- **Deck Camera**—Digital camera(s) housed in a waterproof (minimum IP66 rating) low profile fixture, capable of providing color images of the deck area at a sufficient resolution and frame rate (typically 5 to 10 FPS) to validate the fate of fish that pass from view of the rail cameras (longline vessels) or species identification and fate determination (pot gear vessels). Deck camera(s) are activated only during hauling events to avoid constant recording, and have adjustable run-on times to accommodate final deck sorting after the haul.
- **Sea Bird Camera (longline vessels only)**— Digital camera, housed in a waterproof (minimum IP66 rating) low profile fixture, capable of providing color images of the vessels wake area at a sufficient resolution and frame rate to validate presence/absence of seabird streamer lines (typically 1-5 FPS). Seabird cameras are typically activated by deck equipment rotation, hydraulic pressure, or vessel speed to avoid constant recording.
- **Hydraulic pressure sensors**—Pressure transducers appropriate for the deck equipment on the vessel (typically 0-3000 PSI) which can transmit gradations of hydraulic pressure as changes in base line voltage to activate camera recording during hauling events.

- **Rotation sensors**—Sensors capable of monitoring the rotation of deck equipment, such as a longline drum, and transmitting a signal to the control center to activate camera recording during hauling or setting events.
- **GPS**— Must provide a digital data stream of time, vessel location (lat/lon), speed, heading, and position accuracy to the control center for recording – time and location must be available on a per frame basis.

**EM System Operating Software—**

- **User interface**-- Operating software must provide a “fisherman friendly” user interface to support vessel operator responsibilities and display video images and system operation status at all times when powered. Operating software should provide a separate user interface for EM service technicians to aid in on-site diagnostic and repair work.
- **Function test**—Operating software must provide a system health check capable of being executed by vessel operator to document EM system functionality prior to departing in a trip.
- **Independent camera activation**— Operating software must enable event based activation of camera recording based on a variety of sensor inputs such as vessel speed, rotation of deck equipment, and/or hydraulic pressure. Each camera should be independently activated with configurable “run-on” times after sensor trigger ceases to record final deck activity.
- **Sensor configuration**—Operating software must enable setting of vessel-specific, sensor threshold values which trigger activation of camera recording.
- **System security**— Operating software must provide system diagnostic files (i.e. system operation status, error detection, input voltage, operator commands etc.) of sufficient detail to support forensic determination of system malfunctions. These files should be password protected to prohibit access or tampering by vessel crew.
- **Data Encryption**—All sensor and video data must be encrypted using industry-standard encryption.

**EM Review Software**--EM reviewing software must allow human reviewers to efficiently time synchronize all sensor and video data streams, view sensor data, identify fishing events, review camera footage, and log species identification and disposition. It must include:

- A timeline that displays all information collected by the sensors to aid in detecting fishing events;
- A map showing vessel position and track line time synched with sensor data to aid in identifying fishing events;
- A means to display and time synchronize video files from individual cameras to support determination of species identification and disposition;
- The ability to start, stop, fast forward or reverse video images, view video images frame-by-frame, and jump between different date and time periods;
- The ability to capture reviewer annotation on:
  - Metadata:

- Data/vessel name, target fishery, gear used, start and end of a trip (date/time/location/port, set date/time/location, haul date/time/location/sensor and video gaps (or missing video), effort (number of hooks or skates)
  - Haul-specific catch data (ability to link to a specific haul):
    - Species identification/disposition/quantification, halibut release method and condition, seabird streamer line presence/absence, seabird extended presentation, trip-level sensor gaps (identify and classify), post-haul-review data (data confidence, image quality, reviewer name, etc.), etc.
- The ability to support pre-loaded species and port lists
- The ability for reviewers to use custom assigned 'hot keys' on their keyboard for species data entry and video playback control
- A means of clipping and exporting video and sensor data for seabird identification, archiving, or enforcement purposes; exported data must be in formats suitable for use with other software (XML, CSV, JSON, MP4, AVI, etc.)
- Customizable data quality and control alerts for data reviewers (ex. messages appear in the program when certain required fields aren't filled in by a reviewer).
- Data decryption keys to couple with encryption features of EM system operating software.
- Box graphs along the timeline that enable reviewers to quickly identify events of interest based on defined sensor data values or intervals (ex. time gaps).

**Technical Support**--EM equipment and software providers active in the 2017 EM pre-implementation program must:

- Provide technical assistance to vessels, upon request, in EM system operation, the diagnosis of the cause of malfunctions, and assistance in resolving any malfunctions. Technical support must be available by phone 24-hours per day, seven days per week, and year-round. Technical support must also be available by email.
- Submit critical failure notices and requests for technical assistance from vessels to PSMFC, including when the call or visit was made, the nature of the issue, and how it was resolved.
- Provide technical and litigation support to NMFS or its agent including:
  - Assistance in EM system operation, diagnosing and resolving technical issues, and recovering corrupted or lost data.
  - Support for inquiries related to data summaries, analyses, reports, and operational issues with vessel representatives.
  - Litigation support to NMFS if the EM system/data is being admitted as evidence in a court of law. All technical aspects of a NMFS-approved EM system are subject to being admitted as evidence in a court of law, if needed. The reliability of all technologies utilized in the EM system may be analyzed in court for, inter alia, testing procedures, error rates, peer review, technical processes and general industry acceptance. The EM service provider must, as a requirement of

**Commented [DO1]:** What is current availability of tech support under PSMFC RFP?

the provider's permit, provide technical and expert support for litigation to substantiate the EM system capabilities or other relevant information to investigate or establish potential violations of this chapter or other applicable law, as needed, including: (i) If the technologies have previously been subject to such scrutiny in a court of law, the EM service provider must provide NMFS with a brief summary of the litigation and any court findings on the reliability of the technology. (ii) Sign a non-disclosure agreement limiting the release of certain information that might compromise the effectiveness of the EM system operations.

- o Supply all software necessary for accessing, viewing, and interpreting the data generated by the EM system, including maintenance releases to correct errors in the software or enhance the functionality of the software.
- o Notify NMFS within 24 hours after the EM service provider becomes aware of the following: (i) Any information regarding possible harassment of EM provider staff; (ii) Any information regarding possible EM system tampering; (iii) Any information regarding a prohibited action; and, (iv) Any information, allegations or reports regarding EM service provider staff conflicts of interest..
- o Notify NMFS of any change of management or contact information or a change to insurance coverage.
- Provide field technician training and support in 3 primary ports for longline vessels (Sitka, Homer, Kodiak)

#### **Installation and field services**

EM system installation and field service providers active in the 2017 EM pre-implementation program must provide installation, maintenance and support services, including maintaining an EM equipment inventory, such that all deployed EM systems perform according to the performance standards. In performing these services EM field service providers must:

- Provide installation services within 2 weeks of notice in primary ports (longline vessels).
- Provide limited installation services based on scheduled travel to remote ports (longline vessels).
- Provide on-site maintenance and repair services within 48 hours of receiving a call in primary ports.
- Ensure that field service events are scheduled and carried out with minimal delays or disruptions to fishing activities.
- Develop a VMP for each vessel and submit it to PSMFC for approval within 24 hrs. of installation.
- Comply with data integrity and security requirements, including requirements pertaining to hard drives containing EM data.
- Provide standardized programmatic communication including vessel operator feedback forms, vessel service reports, and critical failure notices.
- Submit critical failure notices and requests for technical assistance from vessels to PSMFC, including when the call or visit was made, the nature of the issue, and how it was resolved.

- Provide technical and litigation support to NMFS or its agent including:
  - Support for inquiries related to data summaries, analyses, reports, and operational issues with vessel representatives.
  - Notify NMFS within 24 hours after the EM field service provider becomes aware of the following: (i) Any information regarding possible harassment of EM provider staff; (ii) Any information regarding possible EM system tampering; (iii) Any information regarding a prohibited action; and, (iv) Any information, allegations or reports regarding EM service provider staff conflicts of interest.
  - Notify NMFS of any change of management or contact information or a change to insurance coverage.