**EM hardware, software, and field support elements
necessary to support Alaska fixed gear EM program structure**

Draft 7/22/2016 for discussion at EM Workgroup

Hardware:

- **Control Center**-- The control centre should be an independent, fully enclosed, device containing the operating software and data storage components of the EM System. It must be:
    - Powered from a single source and capable of accommodating a range of power quality and input voltages from 12V – 32V DC or 110V AC;
    - Designed for a vessel wheelhouse environment to standards that minimize possible impact with other electronics and instrumentation. (e.g. BS EN 60945);
    - Capable of receiving and processing inputs from at least 6 CCTV cameras at speed of up to 15 frames/second;
    - Must have capacity for receiving, processing, and logging data from at least 4 independent sensors including GPS, hydraulic pressure, engine pressure, battery voltage, deck equipment rotation, and RFID readers;
    - Contain a hard drive for data storage capable of being removed/replaced by vessel operator and mailed in for EM review. Hard drives should have sufficient capacity to store approximately 1 month of fishing activity (e.g. 1 TB);
    - Contain an uninterruptable power supply (UPS) to allow data to continually be logged during temporary brown our or short power fluctuations, and which is capable of providing sufficient run time to for sensor, video recording, and operating software to shut down with minimal data loss.
    - Have "quick disconnect" connections to allow easy removal and installation on multiple vessels/yr.
    - Able to withstand a marine environment (control center, sensors, and all cameras)
- **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)**—Internet Protocol (IP) based camera(s), powered by the control center, housed in a waterproof (minimum IP66 rating) low profile fixture, capable of providing color images of the hauling and discard areas at a minimum of 5 frames/second (FPS); adjustable run-on time (to avoid constant recording).
- **Deck Camera**— Internet Protocol (IP) based camera(s), powered by the control center, housed in a waterproof (minimum IP66 rating) low profile fixture, capable of providing color images of the deck area in order to validate the fate of fish that pass from view of the rail cameras at a minimum of 5 frames/second (FPS), adjustable run-on time (to avoid constant recording).
- **Sea Bird Camera**— Internet Protocol (IP) based camera, powered by the control center, housed in a waterproof (minimum IP66 rating) low profile fixture, capable of providing color images of the vessels wake area in order to validate presence/absence of seabird streamer lines at a minimum of 1 frames/second (FPS).
- **Hydraulic pressure sensors**—0-3000 PSI pressure transducers which can transmit gradations of hydraulic pressure as changes in base line voltage to activate camera recording during hauling events.

Commented [DO1]: Do we need 6, or are most boats working well with 4 or less

Commented [DC2]: I've talked to skippers in other regions who knew the control centers were not built for the marine environment even as it was being installed. Their experience told them that connections that worked on their living room TVs were not appropriate for a wheelhouse.

Commented [CD3]: We are currently working with 5 FPS, and this is working well

Commented [DC4R3]: I agree with Courtney. This is a red herring. I suspect there are vendors with an inferior product that try to enhance it by goosing up their frame rates. The images are still lousy, there are just more of them.
I suspect there are other vendors who may be more interested in approaching the problem as an academic exercise, increase frame rates because it sounds cooler. They are not always concerned with the downstream impacts (like increased video storage needed to support the images).

Commented [DO5]: Not required on Pot boats.

- **Rotation sensors**—capable of transmitting an electrical signal activated by rotation of deck equipment, such as a longline drum, to activate camera recording during hauling or setting events.
- **Engine operation sensors**—capable of transmitting an electrical signal to the control box when the vessels main propulsion engine is operating to automatically power down control center when engine operation ceases to avoid battery drain.
- **GPS**— must provide a digital data stream of time, vessel location (lat/lon), speed, heading, and position accuracy to the control center – time and location must be overlaid onto each video frame and also integrated into the sensor data.

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 allow event based activation of camera recording based on vessel speed, rotation of deck equipment, or hydraulic pressure. Rail, deck and seabird cameras should be independently activated with independently configurable run-on times after deck activity ends.
- **Geo-fencing**—The system must have the capability of controlling video recording using geographical areas such a port boundaries.
- **Sensor configuration**—Operating software must allow custom configuration of threshold sensor values which trigger camera activation for each vessels unique operating profile.
- **Engine off sleep mode (sleep sensor)**— Operating software should allow EM system to power down when engine is off to minimize drain on the vessel battery, and allow automatic restarting of the EM system when the engine resumes operation.
- **System security**— Operating software must provide password protected files which prohibit access by vessel crew and which log: time, system operation, operator inputs, sensor operation, and vessel position.
- **Data Encryption**—All sensor and video data must be encrypted using the industry-standard encrypting file system (EFS)

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;

Commented [DO6]: How is this currently used?

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- o 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. (I think PSMFC can add to this list the data they are capturing);
- o Ability to support pre-loaded species and port lists
- o Ability for reviewers to use custom assigned 'hot keys' on their keyboard for species data entry and video playback control
- o A measuring tool capable of determining fish length within the video frame;
- o A means of clipping and exporting video and sensor data for seabird identification, archiving, or enforcement purposes;
  - ▪ Exported reviewer data must be in a format that can easily be fed into a database (ex: XML format)
  - ▪ Exported video data must be accessible for viewing in standard media player formats (e.g., mpg, mp4, etc.);
  - ▪ Exported sensor data must be in a format to import into standard data formats (i.e., spreadsheets, Access Data bases, etc.);
  - ▪ Exported analysis interpretation data must be in a format to import into standard data formats (i.e., spreadsheets, Access Data bases, etc.);
- o 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).
- o Data decryption keys to couple with encryption features of EM system operating software.
- o 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).

Field Support

- • Field technician training and support in X (?) primary ports (Sitka, Homer, Kodiak, Petersburg, Seward, Sand Point, Dutch Harbor have all been suggested)
- • Installation services within 2 weeks of notice in primary ports
- • Limited installation services based on scheduled travel to remote ports
- • Call-in technical support to vessel operators 24 hrs/day.
- • On-site maintenance and repair services within 48 hours of receiving call in primary ports
- • VMP development and approval within 48 hrs. of installation
- • Standardized programmatic communication--- including vessel operator feedback forms, vessel service reports, and critical failure notices.

Commented [CD7]: Is this a requirement now?

Commented [DO8]: Budget exercise with Sam might define # of primary ports.