Appendix 2: Glossary and technical Electronic Monitoring standards

Proposed Interim Standards, Specifications, and Procedures (SSPs)

This document addresses the following Standards, Specifications, and Procedures (SSPs):

SSP1a: On-board EM systems

SSP1b: EM hardware and software in Data Review Centres (DRCs)

Terms and Definitions

Ancillary Logs - Data records from the EM system that are supplemental to the EM Records, such as a record of changes in system configurations and settings and a summary of system health checks performed.

Artificial Intelligence (AI) – A machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments. Artificial intelligence systems use machine and human-based inputs to (A) perceive real and virtual environments; (B) abstract such perceptions into models through analysis in an automated manner; and (C) use model inference to formulate options for information or action.

Cold Data Storage - The storage of inactive data that is rarely used or accessed. Cold data storage takes longer to access but is generally much cheaper to store.

Control Centre - The EM control centre is a computer and software system that records and stores information from EM System components (e.g., video, sensor data, GPS data, system log data) and also controls the operation of onboard EM system components.

Custodian - A person or organisation designated by the EM records and EM data owner to manage authorization and storage of EM records and EM data. There may be a different custodian for records and data.

Data Lake - A storage repository that holds raw data in its native format until it is needed for analytics applications.

Data Records - Actual records or entries in a data file or database.

Data Review Centre (DRC) - A facility or entity with supporting software platform(s) used to analyse e-monitoring records and record e-monitoring data.

Designated Installer or Service Technician - A person or entity authorised by an EM Service Provider to install or service an EM System.

EM Analyst - A person qualified by the appropriate EM Programme provider to analyse e-monitoring records and record e-monitoring data in accordance with the EM standard and analysis procedures.

EM Analysis - See EM Records Analysis/Interpretation.

EM Analysis Rate - The proportion of e-monitored records that are analysed.

EM Certifier - An individual or organisation which has been approved by the appropriate authority to inspect and approve e-monitoring systems for use.

EM Data - Data produced through analysis of e-monitoring records that conforms with the data standards specified in the SSPs.

EM Data Quality Reviewer – A EM Analyst who reviews EM Data to verify and validate information produced by the EM Analyst.

EM Programme - A process administered by a national fisheries regulator(s) [Chair: is there a better term commonly used for other WCPFC systems?] of the flag state that includes the use of EM systems on vessels to independently collect and verify fisheries data and information.

EM Records - Footage (still images and video) and sensor data recorded by an EM System that can be analysed to produce EM Data. Sensors may include any number of sensors (e.g., hydraulic sensors) that are part of the EM equipment and whose data is recorded on the vessel as part of the EM system.

EM Records Analysis/Interpretation - The process of an EM Analyst reviewing EM records and converting them into EM Data.

EM Service Provider - A provider of EM technical and logistical services. An EM Programme may have multiple EM Service Providers and they may provide different services within the programme (e.g., onboard hardware, DRC software, DRC review services).

EM System - All the vessel and shore-based components supporting the generation, storage, transmissions, analysis and reporting of EM Records.

Event - An occurrence in the EM Records that is enumerated into EM data.

Fishing - as defined in WCPFC Convention Article 2(d)

Fishing Trip - The collection of EM records from the time of a vessel's departure from port until the return to port. [Chair: For some large longline vessels 'port to port' could be many months].

Geolocation device - A device that is used to capture information on vessel position, speed, and heading.

Independent - with respect to audits - no financial or current employment interest with the DRC

Machine Learning (ML) - A subset of AI that refers to the use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyse and draw inferences from patterns in data.

Observer - personnel who are trained under a common framework (WCPFC ROP and other accredited national or sub-regional programmes etc) to observe, collect, record and report on fishing activities both at sea and in port.

Owner - The CCM Member or entity that owns the EM Records and EM Data.

Regional Agency - A regional or sub-regional organisation that supports CCM national EM Programmes and EM Systems.

Review for Data Quality - The verification process of re-analysing/interpreting a portion of previously analysed EM records to determine completeness, adherence to protocols, and accuracy of the EM Data produced by the EM Analyst.

Sensors - EM systems may be equipped with a variety of integrated sensors that can provide additional information on fishing activity, trigger activation or adjustment of configurations of cameras, and identify points of interest to expedite EM video review. This may include "synthetic sensors" that use camera imagery used to capture imagery of fishing activities.

Uninterruptible power supply (UPS) - Provides power to the system and enables controlled shutdown in the event of a power loss. [Chair: need to confirm alignment with comparable VMS SSPs]

User interface - A display that communicates EM system status messages and provides views of onboard cameras.

Vessel Monitoring Plan (VMP) - A document describing how an electronic monitoring system is specifically positioned and configured on a vessel (e.g. camera placement with images of camera views and types and locations of sensors) to allow effective monitoring of fishing activity and accurate generation of EM Data specified by the EM Programmes.

Vessel Operator - any person who is in charge of, directs or controls a vessel, charterer and master.

VMS - systems employed to monitor the position of fishing vessels for the purpose of effective management of fisheries.

SSP: Onboard EM Systems

Onboard EM Systems comprise all vessel components supporting the acquisition of and reporting of EM Records. Onboard EM Systems shall be configured such that they collect the information set out in a relevant WCPFC agreed minimum data standards [1]. The core EM System components covered in these SSPs are: control centre, user interface, cameras, geolocation device, uninterruptible power supply, sensors, and communication system. Together, these components ensure that required information is collected, including system health status, to support fisheries management and enforcement objectives.

On-board EM System component	SSP
1. Control centre	The EM system control centre: a. MUST control all onboard EM hardware components. b. MUST be able to connect to the vessel's power source and sustain this power source throughout the duration of the fishing trip.] c. MUST store and SHOULD transmit system health status information (See System Health Status). d. MUST have sufficient storage capacity for all EM Records required to be generated [during a fishing trip] until EM Records are transmitted to a DRC for review. e. MUST have sufficient backup storage to mitigate potential data loss. f. SHOULD have unambiguous and unique identification of storage devices (e.g., barcode on hard drives). g. MUST allow EM records to be transmitted, stored or accessed surely. To secure EM records, the system SHOULD be equipped with applications such as user logins, EM record encryption and firewalls.

[1] For example, such as in the current draft of the Data Collection Committee (DCC) Longline EM Minimum Data Fields Standards (NOV-2020), which may be revised in the future.

On-board EM System component	SSP
	h. SHOULD store all EM Records on storage devices and in formats that are compatible or can be readily translated into formats that are compatible with DRC hardware and EM review software.
2. User interface	The onboard user interface: a. MUST include a display on the vessel. b. MUST include software that shows EM system health status (System Health Status) and real time images from installed cameras on the display. c. MUST allow only authorised users (e.g., EM Service Providers, EM service technicians) to adjust system configurations. d. COULD Include a keyboard, mouse, touchscreen, or other device to allow user inputs to the system.
3. Cameras	a. An EM system MUST be outfitted with cameras to capture imagery of fishing activity. b. The number and position of cameras MUST be sufficient to capture necessary imagery to collect, in accordance with WCPFC measures. c. Cameras MUST, capture imagery that meets image quality standards under typical fishing conditions that allow for an EM Analyst to extract all required data fields (subject to any conditions with respect to footnote ~~**Error! Bookmark not defined.**~~ [6]). As a minimum standard[2] [Chair: there was overwhelming feedback that these minimum standards for resolution etc. needs to be a MUST, however further discussion is needed to determine the appropriate values and this has implications across RFMOs] : 1. Frame rate [MUST/SHOULD] be no lower than [x/5fps] for any imagery requiring identification of catch or bycatch; and

[2] Other camera configurations (e.g. shutter speed, bitrate etc.) may vary to balance collection of adequate footage versus storage needs

Commented [AT1]: Suggest Min standards for resolution is a MUST. Recognized the need for discussion with the technical experts on the appropriate values in (1) and (2) below

On-board EM System component	SSP
	2. Resolution [MUST/SHOULD] be no lower than [x/720p] for any imagery requiring identification of catch or bycatch b. See also (Vessel Monitoring Plan) c. COULD be capable of accommodating remote or onboard configuration of parameters to optimise camera functionality throughout a typical fishing trip; Recorded imagery: d. SHOULD be recorded in a widely used and accessible video or image file format, such as MP4 or JPEG, or other compression standards that are able to be viewed. e. SHOULD include a timestamp, GPS location, and WCPFC VID (vessel identification information) on the video or image.[Chair: it was generally agreed that it MUST be possible to link footage to this information (i.e., collect as meta-data), but it need not be a 'MUST' to watermark it at the point of footage capture.]
4. Geolocation data and device	a. A geolocation device[3] MUST record vessel location coordinates and the associated date and time in a format capable of integration with EM Records b. The geolocation device MUST be installed and remain in a location in accordance with the manufacturer's guidelines such that the device can reliably function. c. The EM system SHOULD transmit geolocation data and associated date and time, and vessel identification information to DRCs on a regular basis, as defined by the relevant programme requirements, throughout the duration of a fishing trip in a format compatible with DRC software.

[3] The EM system may use an existing geolocation device on type-approved hardware on the vessel (e.g., VMS) or have its own geolocation device.

On-board EM System component	SSP
	d. The EM system SHOULD be able to verify whether transmissions of geolocation data and associated date and time, and vessel identification information to DRCs are successful. e. If the EM system is unable to transmit geolocation data due to a communication error, it SHOULD store geolocation data and automatically send it as soon as practically possible after communication is restored. f. The vessel location and timestamp data from the geolocation system MUST] be associated with the EM records.
5. Uninterruptible power supply	The EM system SHOULD include a UPS in the event that the main source of power is interrupted.
6. Sensors	a. EM systems SHOULD be outfitted with sensors, which may include the use of camera imagery as a synthetic sensor, to capture information about fishing activity. These may include, but are not limited to: i. Pressure sensors ii. Hydraulic or drum rotation sensors iii. Temperature sensors iv. Door open/closed sensors v. Proximity sensors vi. RFID readers b. If ~~T~~he EM system is outfitted with sensors, then it SHOULD be capable of generating and recording a log file of readings from system sensors stored in a similar manner to time and geolocation information.
7. Communication system	a. The EM System SHOULD have or integrate with at least one network communication system that enables the reliable and regular transmission (e.g., daily or weekly, hourly) of near-real-time data on system health

On-board EM System component	SSP
	(including still images for EM system status verification when prescribed by the programme requirements), sensors (if applicable), and geolocation to DRCs during all fishing activity, and supports remote access to the EM system by the EM Service Provider or their designated service technicians. b. The network communication system(s) SHOULD be a widely used and globally recognized technology, such as i. 3G, 4G, or 5G cellular networks. ii. Wi-Fi iii. Satellite communications. c. The EM system SHOULD be able to verify whether transmissions of data on system health (including still images), sensors, and geolocation to DRCs are successful. d. The EM System SHOULD have ethernet or any other communication system allowing data transfer and remote access to the system via the onboard connection.

General Requirements for onboard EM Components	
1. Weather Resistance	EM hardware components that are utilized on deck and are exposed to the elements (e.g., sensors and cameras) MUST be sufficiently dust and water resistant (e.g., IP66) and durable (e.g., corrosion, impact, and vibration resistant) to operate reliably under the range of conditions expected in their location on fishing vessels. IP67 or IP68 SHOULD be used for those locations where significant water contact is expected.
2. Tamper Resistant and Tamper Evident	a. The onboard hardware MUST be robust and tamper evident to mitigate the risk of intentional sabotage or malfunctions. This shall include physical and/or software features. b. The EM System SHOULD feature a login history tool which allows the tracking of information on when and by whom system configuration settings have been accessed offering insights into possible tampering attempts.
3. Compatibility with Other On Board Equipment	The EM System SHOULD be capable of functioning in close physical proximity to other onboard electrical and hydraulic equipment (i.e., EM System operations MUST not be materially impacted by the presence of other onboard electrical equipment and MUST not materially impact the proper functioning of other onboard electrical equipment).
4. Compatibility with DRC Review Software	All EM Records generated by the EM system MUST be in a compatible format, or be able to be converted into a compatible format, to allow the ingestion of the EM Records into an analysis software being used.
5. Capable of Spatial Calibration	An EM system SHOULD have capability for spatial calibration for accurate image and fish length measurements. [Chair: does this require something to be added to the section on camera placement and measurements]
6. System Health Status	The system SHOULD execute a system health test either automatically or when initiated by user and MUST provide a visual signal on the display that the system is operational (i.e., it should be obvious, simply by looking at the display, whether or not the system is working) . [Chair: feedback not yet incorporated AU - Suggested edit noting that there are different tests that can be carried out (e.g., testing camera views, gear sensor inputs that require activation etc).

	ISSF - Cross reference with Table 1 On-board EM System component, 1: Control Centre - b. MUST be powered on and remain on while the vessel is underway and during all fishing activity including during any at sea vessel rendezvous activity. Consider how these two work together.] a. The EM system MUST be able to generate a log file including, but not limited to, the following EM processes to capture the operational health status of the system: i. System power up ii. System shutdown planned iii. System shutdown unplanned (e.g., power cut) iv. Camera connectivity v. Camera recording start and stop times (planned) vi. Camera recording error[4] vii. Available hard drive space viii. Sensor connectivity, if applicable ix. Sensor recording start and stop times (planned) , if applicable x. Sensor recording error , if applicable xi. Activation and deactivation of recording triggers (e.g., vessel speed, drum rotation sensors, geofencing, and time scheduled), if applicable b. System SHOULD undertake regular system health checks throughout the duration of the fishing trip at a frequency defined by the EM Programme and MUST show malfunction alerts (errors and warnings) on the display of the user interface (Onboard User Interface) of the control centre. c. The EM system COULD be able to capture and store single frame images from each onboard camera on a regular basis (e.g., timed intervals, such as hourly, or on event triggers such as geofences) to show that cameras are operational, not obstructed, obscured, or displaced.

[4] The appropriate time interval may require regular review and updating.

Installation, Operation, and Service of onboard EM Systems	
Requirement	SSP
1. *EM system installation*	The EM Service Provider or their designated installer: a. MUST coordinate installation with the vessel owner or their designated representative. b. MUST install an onboard EM system that meets the performance standards described in onboard EM System Component and General Requirements. c. MUST ensure the onboard EM system meets the performance standards described in onboard EM System Component and General Requirements through system tests. d. MUST provide the necessary information for the vessel owner/operator or their designated representative to complete a Vessel Monitoring Plan (Vessel Monitoring Plans) or complete the Vessel Monitoring Plan on behalf of the owner/operator. e. MUST brief the vessel operator and crew member(s) and provide documentation on EM system operation, maintenance, and procedures to follow during regular operation and in the event of a system malfunction (Vessel Monitoring Plans). f. MUST submit notification to the relevant EM Programme of system installation in the agreed form that attests to the system functionality and its conformance with the performance standards described in onboard EM System Component and General Requirements. (See SSPs on EM Records and EM Data Security and Confidentiality)[5] The vessel owner or their designated representative:

[5] Note: A standardised regional form could be useful for this purpose

Commented [AT2]: This links to SSPs that are not being considered.

Installation, Operation, and Service of onboard EM Systems	
Requirement	SSP
	a. MUST provide information[6] describing the vessel configuration and systems to facilitate EM system installation. b. MUST make the vessel and appropriate personnel (such as engineers, fishing master, multilingual staff, etc.) available and provide the EM Service Provider unfettered access, including to the ship's power supply, to complete EM system installation.
2. Vessel Monitoring Plan	a. Vessel owner or EM Service Provider MUST complete a Vessel Monitoring Plan, and submit it to the EM Programme for approval.[7] b. A copy of the Vessel Monitoring Plan MUST be kept on board the vessel. c. Vessel Monitoring Plans MUST be updated and submitted to the EM Programme at a frequency determined by the EM Programme and anytime changes are made to information or requirements outlined in the VMP (e.g., new vessel contact information, change in EM System configuration, change in catch handling guidelines). d. The Vessel Monitoring Plan: i. MUST include contact information for the EM Service Provider, vessel owner(s), and vessel operator(s), and base manager(s) (if applicable). ii. MUST include General vessel information as specified in the vessel identification section of the latest version of the regional minimum data field standards. iii. MUST include a diagram, description, and photo(s) of the vessel layout that identifies where key fishing activities will occur on the vessel (e.g., hauling, sorting, discarding) and COULD include measurements of all

Commented [AT3]: This relates to the work on data fields, which is yet to be determined.

Commented [AT4]: Dependent on program objectives; ie some don't collect length measurements

[6] Note: A standardised regional form could be useful for this purpose

[7] Note: A standardised regional form could be useful for this purpose

Installation, Operation, and Service of onboard EM Systems	
Requirement	SSP
	items, tools, or areas on the vessel that EM to support estimation of lengths of fish caught. [Chair: This is vague – what things need to be measured? To what level of accuracy?] iv. A description of the EM setup: ● MUST include the number and location of cameras including images of their installation location and an image from each camera's perspective, and include nighttime images, as appropriate, to demonstrate sufficient lighting. ● MUST include a description and image of the location of all other components of the installed EM system (e.g., geolocations system, EM control system, sensors, power supply). ● MUST include relevant details of system configuration settings, including: ○ Camera configuration settings (e.g., frame rates, resolution, bitrate) ○ Sensor units and threshold values, if applicable ○ Data recording frequencies and/or sensor triggers for recording ○ Software and Firmware versions ○ Spatial calibration settings, if applicable v. MUST include any catch handling procedures required to ensure that EM Records collected allow for an EM Analyst to generate EM Data for all the required data fields (e.g., handling in view of cameras, allowable discard locations). vi. MUST include vessel duty of care responsibilities to prevent system malfunctions and ensure effective operation of the system, such as: ● Verifying system functionality at the beginning and throughout the duration of each trip ● Instructions for cleaning camera lenses

Installation, Operation, and Service of onboard EM Systems	
Requirement	SSP
	vii. MUST include vessel responsibilities in the event of system malfunctions that describe the steps that must be taken.
3. Field and Technical Support Services	The EM Service Provider, in a timely manner, SHOULD: a. Communicate with vessel operators and the relevant EM Programme to coordinate service needs, resolve specific programme issues, and provide feedback on programme services. b. Provide maintenance and support services, including software and firmware updates, such that all installed EM systems perform according to the performance specifications described in onboard EM System Component and General Requirements and that field services are scheduled and completed with minimal delays to minimise disruption to fishing operations. c. Provide technical assistance to vessels upon request on EM system operations, diagnosing causes of system malfunctions, and providing assistance for resolving malfunctions. This assistance SHOULD be available 24 hours a day, seven days a week, year-round. This service must be provided in the relevant languages as defined in the programme specifications. d. Submit to the relevant EM Programme, and the EM Certifier, where appropriate, reports of all requests for technical assistance from vessels and service calls that include: i. The name and designation of the vessel point of contact ii. The date(s) and time a request for service was made. iii. The date(s) and time(s) when the EM Service Provider called or visited the vessel to provide technical assistance. iv. A description of the issue.

Commented [AT5]: A service provider MUST take direct responsibility of the following technical support as a whole principle.

Commented [AT6]: There was a view that this should be a MUST?

Installation, Operation, and Service of onboard EM Systems	
Requirement	SSP
	v. A description of how the issue was resolved, including actions completed during all service calls or visits in response to the request for service. vi. The date and time the issue was resolved. The vessel owner/operator: a. MUST follow duty of care responsibilities described in the Vessel Monitoring Plan. b. MUST report EM system malfunctions to the appropriate contact as outlined in the Vessel Monitoring Plan. This should be done as soon as is practicable, and include details of the date, time, and, if possible, the geolocation when the malfunction was first detected. c. MUST follow vessel responsibilities outlined in the Vessel Monitoring Plan in the event of system malfunctions. The EM Programme: a. MUST define vessel responsibilities in the event of system malfunctions that describe the steps that must be taken under different failure scenarios. b. SHOULD respond to EM Service Providers or vessel owners/operators in a timely manner.

Commented [AT7]: MUST (?) - To meet the efficiency standards.

SSP: Data Review Centres

A data review centre (DRC) is an entity with access to supporting software platform(s) used to analyse EM Records and generate EM Data. DRCs may serve individual CCMs, subregional groupings, or the entire WCPFC membership. They may also be administered by individual CCMs members, a sub-regional or regional body, or a third-party (commercial) provider. This SSP is not specific to any DRC structure and covers the required infrastructure (hardware and software) to analyse EM Records.

DRC Component	SSP
1. EM Analysis Software ***NOTE: This section requires further discussion on Interoperability.*	The DRC MUST use EM analysis software to facilitate the generation of EM Data from EM Records. The EM analysis software: a. SHOULD be compatible with the file types, data structures, syntax, and semantics of EM Records that will be analysed with the software. b. SHOULD be the latest version of analysis software, including security patches c. MUST be able to display EM analysed output: i. Display the vessel track on a map based on geolocation data integrated in the EM Records, with an option to display the geolocation data of each vessel. ii. Display synchronised imagery from all cameras simultaneously with zoom capability and other relevant imagery features. iii. Display a visual timeline with sensor readings or status, if applicable. iv. Display synchronised sensor data (including vessel heading and speed) and video imagery simultaneously, if applicable. d. SHOULD be able to spatially calibrate an image and measure the length of species brought onboard as required by the EM Programme (e.g. through a digital measuring tool in the EM analysis software). e. SHOULD allow the EM Analyst to create annotations to mark events where fishing activity occurred within the EM records.

Commented [AT8]: Suggest this is a MUST – it is crucial for the software to be compatible to read the footage.

Commented [AT9]: Calibration is important and we do see this as a MUST and especially if the system is to measure and collect data relating to the length of the fish.

CHECK WITH IT TO UNDERSTAND MORE WHAT IS SPATIALLY CALIBRATE AND IMAGE.....

Commented [AT10]: Software MUST have this annotation capability, especially if it is not automated, in order to assist with analysis.

DRC Component	SSP
	f. SHOULD be able to extract and save segments of video and sensor data, including extraction and saving of still images and the ability to automatically [Chair: What does automatically mean] extract short duration video clips of catch. g. MUST be able to produce EM Data into a format compatible (or that can easily made compatible) with relevant databases used in regional fisheries management organisations to store information on fishing activity. h. COULD be able to import EM records (and related sensor and annotated data) from systems of other EM Service Providers. i. SHOULD have the ability to change the playback speed of the footage (e.g., 0.5x, 1x, 2x, 6x, 8x, 10x)
2. EM Analysis Workstations	The DRC MUST have EM analysis workstation(s) where EM Analysts will use EM analysis software to generate EM Data from EM Records. The EM analysis workstation: a. MUST have hardware and software, or cloud-based platforms that enable effective EM analysis b. MUST have reliable data transmission capabilities sufficient for efficient streaming or download/upload of data required for EM Records analysis, reporting of EM Data, and storage of EM Records. c. SHOULD have proper ergonomics that support analyst well-being, quality, and efficiency.
3 EM Analysts	The use of EM software to generate EM Data from EM Records MUST be conducted by EM Analysts. The EM Analysts: a. MUST complete an appropriate training programme which covers materials including (but not limited to): species ID, basic fishing practices, and EM review processes). b. MUST have an absence of fisheries-related convictions. c. MUST be independent from fishing-related parties including, but not limited to, vessels owners and operators, dealers, processors, canners, traders, shipping companies, fishers, or advocacy groups, to prevent conflicts of interest, whether it be a direct or indirect interest that could affect the performance or

Commented [AT11]: MUST as we see the ability to extract and save segments of video and sensor data, when needed, as crucial for various reasons including for compliance review and monitoring.

We see this ability as crucial and may not need to be done automatically (therefore, we can delete the word "automatically").

Commented [AT12]: SHOULD – whilst this feature may not be available yet, interoperability functions is important and is anticipated, so suggest changing this from COULD to SHOULD.

Commented [AT13]: Standards re Security is yet to be discussed but is it possible to include text around area security of the workstations here, given this information can be commercially sensitive.

DRC Component	SSP
	non-performance of the official duties of the EM Analyst. Any potential conflicts of interest must be declared to their employer and EM Certifier.
4. A system to monitor EM System health on vessels	a. The EM Programme SHOULD have a health monitoring system to receive and display near real-time information of onboard EM System health status (System Health Status), this SHOULD include still images to verify functionality of onboard cameras (System Health Status) and geolocation data (Geolocation device). This system may be part of the DRC. b. The on-shore health monitoring system MUST receive any malfunction alerts (errors and warnings) that have been generated from the onboard health monitoring system. c. The health monitoring system SHOULD be able to display the latest geolocation of all covered EM Systems on a map.

Commented [AT14]: We see having a health monitoring system as crucial so suggest changing this to a MUST.

Whether this system receive and display the info near real-time can be further discussed.

Commented [AT15]: As above, suggest changing this to a MUST - tracking is vital.