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Pacific Islands Region Longline Electronic Reporting

Version <1.0>

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NMFS Pacific Islands Region
Electronic Technologies Steering Committee

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Acronyms and Terminology

Acronym	Definition
BT	Bluetooth
CML	Commercial Marine License
CNMI	Commonwealth of the Northern Mariana Islands
CSV	Comma Separated Value
DBMS	Database Management System
ER	Electronic Reporting
FEP	Fisheries Ecosystem Plan
HILLE	Hawaii Longline Limited Entry
IATTC	Inter-American Tropical Tuna Commission
IFP	International Fisheries Program
ITS	Information Technology Services
JIMAR	Joint Institute for Marine and Atmospheric Research
m	Meter(s)
NMFS	National Marine Fisheries Service
OLE	Office of Law Enforcement
PIFSC	Pacific Islands Fisheries Science Center
PIR	Pacific Islands Region
PIRO	Pacific Islands Regional Office
PMUS	Pacific Pelagic Management Unit Species. Species managed under the Pelagic FEP
QAC	Quick Access Computing
SDK	Software Development Kit
sFTP	Secure File Transfer Protocol
t	Metric Ton(s)
WCPFC	Western and Central Pacific Fisheries Commission
WAP	Wireless access point
WHG (CLSA)	Woods Hole Group (formerly CLS America)
WPRFMC	Western Pacific Regional Fishery Management Council
VMS	Vessel Monitoring System

Executive Summary

Electronic Reporting (ER) has been developed for longline fisheries in the Pacific Islands Region (PIR). The current ER process allows fishers to enter catch and effort data with software on an Android tablet that interfaces with the vessel monitoring system (VMS). Data are then sent via satellite to a receiving station where data are pulled by the Pacific Islands Fisheries Science Center (PIFSC) and incorporated into databases. In 2019, there were 150 active longline vessels in the Hawaii and California-based longline fisheries and 14 vessels in the A. Samoa-based fishery. As of the date of this document, 61 Hawaii and California-based vessels have volunteered to submit ER data. In October 2018, the Western Pacific Regional Fishery Management Council (WPRFMC) took initial action to require ER in pelagic longline fisheries. During voluntary and mandatory reporting, NOAA Fisheries will provide entire funding for the longline ER for vessels based in Hawaii, Hawaii and west coast region permitted vessels based in California and vessels based in American Samoa. To achieve mandatory reporting, ER tablets need to be distributed to the remaining 89 vessels and 14 in A. Samoa. While the ER software is easy to use, it typically requires at least one initial in-person training session to ensure that the hardware and software are working and that data are entered correctly and accurately.

Challenges to the program include: 1) Covid-19 has postponed ER outreach and tablet distribution to the longline fleet, 2) outreach to the Vietnamese and Korean longline sectors of the fleet can be difficult, 3) reluctance to use new technology, 4) captain turnover requires additional training, 5) the introduction of new VMS unit types require additional ER software development and testing and 6) deployment to vessels in American Samoa and California can require travel and/or training of local staff.

Introduction

The purpose of this paper is to outline the current pre-implementation state of Electronic Reporting (ER) for holders of Hawaii and American Samoa longline permits. The purpose of ER is to submit near real-time data submissions that have increased accuracy, reduce data processing time, and more rigorously monitor and forecast the attainment of international longline catch quotas. This is a living document which will be updated as the ER program evolves.

ER cost structure

During voluntary and mandatory reporting, NOAA Fisheries will provide entire funding for the longline Electronic Reporting for vessels based in Hawaii, Hawaii permitted vessels based in California and vessels based in American Samoa. Other U.S. longline fisheries in the Pacific will be responsible for maintaining their own electronic logbook system.

NOAA's Pacific Islands Fisheries Science Center (PIFSC) will be responsible for:

1. PIFSC personnel for outreach, training, technical support and back-end database development,
2. Initially providing 160 tablets with the ER software,
3. Conducting ER software updates,
4. Downloading ER data and incorporating into PIFSC databases,
5. Updating software encryption keys on an annual basis, and
6. Producing an archived re-compiled logsheet for potential use by the Office of Law Enforcement

(OLE).

NOAA's OLE will be responsible for:

1. Providing Vessel Monitoring Systems (VMS) on longline vessels,
2. Providing VMS maintenance and software updates,
3. Providing transmission costs of ER data from the VMS unit and via satellite to a receiving station, and
4. Providing tablets dependent on attrition of the initial 160 tablets. These tablets would be procured from the VMS company along with the VMS unit.

Pre-Implementation of Findings and Outcomes on ER Development

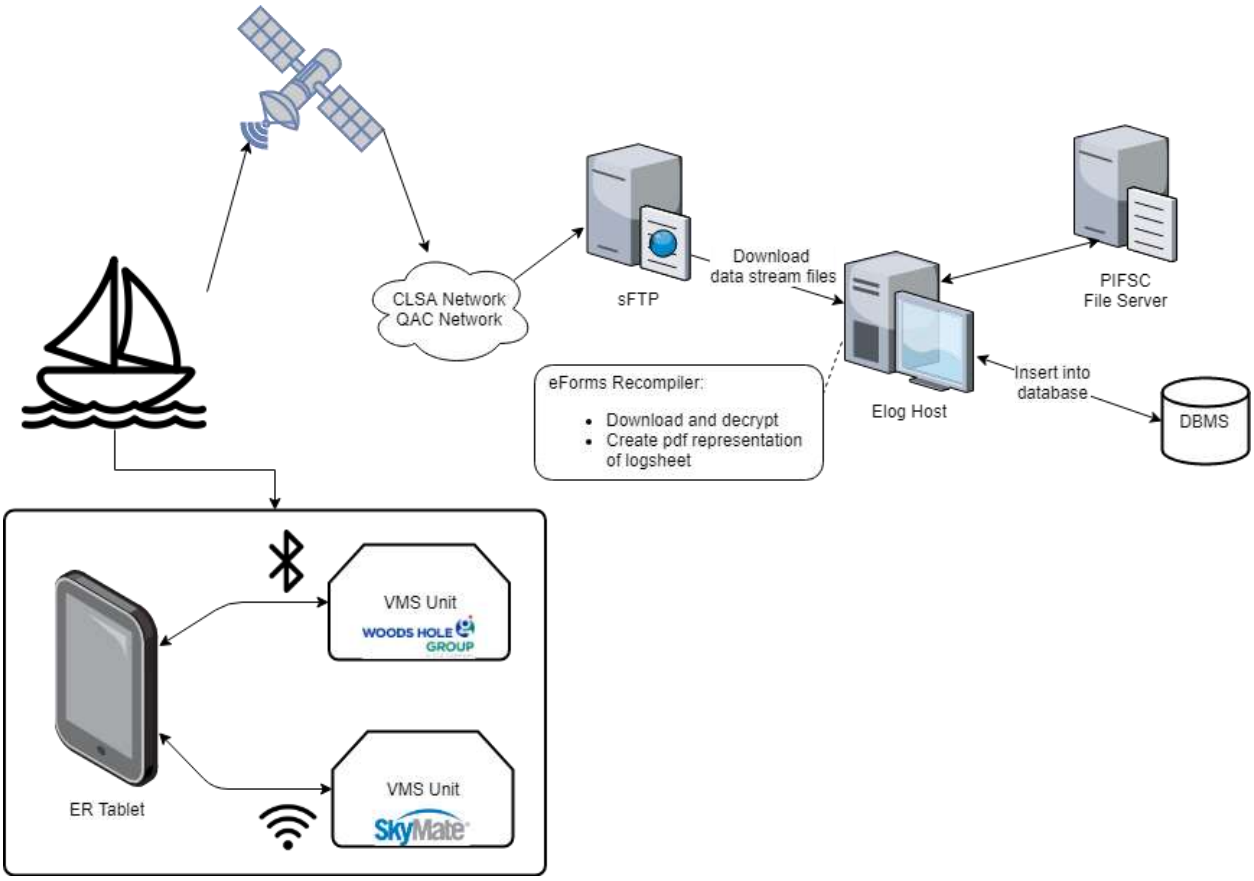

Figure 1: General Electronic Reporting process flow

Data Flow Overview

The current ER process is illustrated in Figure 1. Software on an Android tablet interfaces with the vessel monitoring system (VMS). There are currently two VMS companies that have units installed on longline vessels in Hawaii and American Samoa. Woods Hole Group (WHG, formerly CLS America) has models LEO/THORIUM and TRITON (two different model types), which allow the tablet to interact with the unit via Bluetooth (BT) technology. Skymate has models M1500 and M1600, which allows the tablet to interact with the unit via Wi-Fi. 12 vessels have the discontinued M1500 unit installed. Skymate data transmission is currently being tested.

Data are sent from the tablet through the VMS unit and via Iridium satellite to a receiving station where data are pulled by the Pacific Islands Fisheries Science Center (PIFSC). Data are decrypted inside of the PIFSC firewall and incorporated into Oracle databases where quality control occurs and a PDF version of the re-compiled logsheet is produced for archiving. The PDF version of the re-compiled logsheet is required for the Office of Law Enforcement (OLE). A screen view of individual logsheets is available for OLE to review when boarding vessels. Fishermen can confirm data transmission by referring to the application's e-form queue, data transmission dialogue messages, and "SENT" indicators on e-log set listings.

At PIFSC, quality control reports are generated on all e-logs received and are reviewed by staff. Fishers are contacted when follow-up is necessary.

Software Certification and Acceptance Process

In 2009, WPRFMC, Pacific Islands Regional Office (PIRO), and PIFSC developed draft guidelines for the certification of an ER application software for Hawaii longline vessels (74 FR 32109; NOAA PIFSC 2009). These guidelines were written primarily for electronic logbook vendors. The software goes through a PIFSC certification process where validation testing is conducted by sending simulated logbook data through the ER process and the re-compiled logsheet is compared with the simulated data. Since that time, in 2017, NMFS in partnership with Quick Access Computing (QAC) developed "Elog-It", a software application to replace the paper-based logbook reporting system. In 2019, the PIFSC certified Elog-it for use in the Hawaii longline fisheries to submit production data. NMFS will continues to provide and maintain the "Elog-It" software as there is currently no alternative ER software available.

Hardware Requirements

Tablet Acquisition and Maintenance

Tablets are currently purchased through the application developer and maintained by PIFSC Joint Institute for Marine and Atmospheric Research (JIMAR) staff. Basic troubleshooting can be performed by PIFSC and JIMAR staff at their discretion. As of 1 January 2020, PIFSC has 160 tablets ready for deployment. Tablet attrition has been very low and replacement tablets are not being considered at this time.

Tablet Requirements

The ER application is optimized for the following tablets:

- **Samsung Galaxy Tab S2**; 8 inch screen; 2048 x 1536 screen resolution; USB-micro
- **Samsung Galaxy Tab Active 2**; 8 inch screen; 1280 x 800 screen resolution; USB-C
- **Both** are FIPS (Federal Information Processing Standards) 140-2 certified, which means they meet the National Institute of Standards and Technology's (NIST's) standards for software and hardware cryptography. External service providers are required to use FIPS for processing, storing, or transmitting federal information on information systems.

VMS Acquisition and Maintenance

VMS units that are provided to the Hawaii longline fleet are currently procured and maintained by the OLE. All possible malfunctions with connecting the tablet to the unit shall be reported to OLE for basic troubleshooting. Any issue that cannot be resolved can be escalated to a work order ticket with the

associated VMS vendor. PIFSC and/or vessel operators and owners shall not perform any maintenance on the VMS or request work from the service contractor without consent from OLE.

Currently, OLE PIR maintains the VMS units for all vessels holding a Hawaii Longline Limited Entry (HILLE) and A. Samoa Longline Limited Entry permit and will repair or replace malfunctioning units

VMS Requirements

All VMS hardware type approval requirements can be found at CFR Title 50, Part 500, sub-part Q.

Other Hardware Acquisition

PIFSC has been responsible for acquiring US wall chargers/adapters for the tablets and protective cases for some of them. PIFSC is currently exploring the procurement of tablet mounts.

Android Application Details

The software has been developed by QAC. PIFSC owns the Elog-It software source code. QAC is an Australian company with over 10 years' experience in sustainable software development for fisheries management in the Pacific. A team of 12 software developers and support staff are available to provide a comprehensive service in electronic reporting and data transmission (Table 1).

Table 1. Personnel and contact information at Quick Access Computer for Elog-It software support and development.

Name	Position	Contact
Darren Saunders	QAC Director	darren@quickaccesscomputing.com.au darren@ifims.com
Mark Oates	QAC Manager and Android Developer	mark@quickaccesscomputing.com.au mark@ifims.com
Andrew Trendell	QAC Support	andrew@ifims.com

Elog-it is a native Android application (Java) for use on devices that support Android OS only. The application was developed using the Android Software Development Kit (SDK). Elog-It software collects and transmits data in a FIPS 140-2 Certified Encrypted comma separated values (CSV) string. Collected data are held on the tablet in encrypted database tables.

If the tablet is connected to a WHG VMS unit, the encrypted data are sent via satellite to a QAC server, where it is available for NMFS to download using secure file transfer protocol (sFTP).

When Skymate support is implemented, the encrypted data will be sent via satellite to a server, where it will be available for NMFS to download using secure Web services.

The encryption key is accessed and updated remotely and automatically by the application from time to time when the tablet has access to Wi-Fi. This will ensure that data are encrypted in a manner that meets ITS requirements. There is a secure WAP (wireless access point) at Pier 38 that will serve up the encryption key updates. The software and software updates are available for download as an APK (Android package, or install files for the Android OS) from QAC. PIFSC has software support through QAC

until September 2021. A decision will be made in 2021 if modifications to the Elog-It will occur at PIFSC or externally.

Android Tablet Specifications

Android tablets are required to be FIPS 140-2 Certified and are rugged hardware to meet the demands of at-sea data collection. The minimum Android tablet specifications include:

- Android 4.4 Operating System (KitKat)
- 2Gb of RAM
- 16 GB of Data Storage
- 2GHz CPU Speed
- 8.0 Inch Main Display Size
- GPS Location Technology
- Bluetooth Capability
- Wi-Fi Capability
- FIPS 140-2 Certified

Data Entry Flow

The process of entering an e-log is as follows:

1. User enters Begin Trip information when departing for a trip.
2. User enters Set, Haul and Catch information as fishing operations occur. User may enter this information later if information is not complete.
3. User signs each Set by entering Commercial Marine License (CML), name, and the date. By signing, the user confirms his or her identity and the correctness and completeness of the information recorded. The user must also agree to the acknowledgement that appears as a check box before submitting (transmitting) the set.
4. User enters End Trip information after returning to port.
5. The captain can verify if the data has been sent by referring to the data transmission queue or in the Catch Information records.

Output Format

The output data stream specifications can be obtained from PIFSC upon request (PIFSC email address: pifsc.elogsupport@noaa.gov, ER phone number – (808) 725-5604).

Data are sent in messages that need to be reassembled and decrypted by PIFSC. If any part of the eForm is missing, which is an extremely rare occurrence, the eForm cannot be decrypted and the data are unusable. Data would need to be re-sent from the tablet.

Data Quality and Reliability

The application has data validation for many of the data fields and are illustrated in Appendix 1: Data Validation.

There are a number of Error Checking functions built into Elog-It including checks that all required fields are completed, Positional checks (for when position must be manually entered) and Catch checks (see Appendix 1). The software has a re-transmit option. The system has worked well as only 0.33% of all longline set data had to be re-transmitted.

Additional Features

- **VMS location integration** – Current location can be populated from the VMS unit via on-board API. This requires the condition that the user is entering data as the associated fishing activity is being completed.
- **Set review** – Users are able to review current and previously submitted sets in a format that is visually similar to the paper logsheet form. Currently, e-log data cannot be modified, so users are asked to contact the ER team should corrections or edits be necessary. Making corrections within the software is under consideration as a future feature.
- **Trip catch summary** – Users are able to view current and previously submitted trip summaries, which include a total number of kept and released by species for the associated trip.

Documentation

User Guide Documentation

A 2-page quick guide and a 50-page comprehensive guide have been produced (Appendix 2) and are available in three languages (English, Vietnamese and Korean) on the ER tablets as PDF files. The quick and comprehensive guides (three languages) are available as PDFs on the tablet.

Staff Setup Guide Documentation

A draft Administrative User Guide is available as Appendix 3. This will function as a reference guide for ER staff who need to manage, setup, deploy, and provide technical support on ER tablets.

Data Security

Application User Logins

User accounts are created for individual boat operators who function as vessel captains. Users log in with their Commercial Marine License (CML) number and a password. Users use their unique CML to set up the tablet in collaboration with NMFS Staff. Users are required to set their own Login Password, and an Activation Code for the Elog-It Application is provided by the NMFS Staff. NMFS Staff have Administrative functions available including Activation, Password Reset, Re-Transmit of Data, Account Transfer, and Account Removal.

Users must log in to enter and see their own data. They are also able to look at their trip summaries, where the catch are summed by a particular trip. It is preferred that individual accounts be created for each individual user. However, if a captain allows a relief captain to use his/her account, the relief captain must sign as him/herself (CML and name) when completing electronic submissions.

Data Encryption at Rest and in Transit

Data are sent as encrypted CSV file. The current encryption implementation adheres to FIPS. The following items relate to encryption considerations:

1. Encryption method must satisfy the FIPS 140-2 requirements.
2. Encryption should be implemented via a FIPS certified common off-the-shelf (COTS) library.
3. Using the encryption method chosen, fishing log information should be at least as secure as the current paper log (i.e. a captain locks up completed logs so no one else can see it, the tablet should not allow a casual user to read the logs)

4. Logs should be readable by authorized people (e.g. Coast Guard or OLE while boarding a vessel)
5. Logs should be encrypted from the time data are submitted until it is received by PIFSC or an authorized person (e.g. PIFSC staff; captain that signed the log) retrieves it. This could open up the data transmission methods and allow for more control or competition.
6. The chosen encryption method should minimize the labor and infrastructure required to manage encryption keys.
7. Encryption keys must be able to be expired or renewed. An encryption key is changed once per year.

Initial Outreach, Training, and Setup

Outreach

PIFSC staff has solicited participation in the current ER program since July 2018. The personalized outreach by staff at the Honolulu Pier 38 has led to a generally positive response from both vessel owners, permit holders, and captains. As for fleet involvement, PIFSC tried to make the Elog-It application mimic filling out paper logs as much as possible. Once the general functionality was completed, PIFSC got six captains to do beta testing. PIFSC received comments to improve the application and many suggestions were implemented. All six captains continued to use the application when it went into production.

PIFSC staff must obtain consent from both the captain and permit holder to set up ER on a fishing vessel. PIFSC staff must also obtain permission to board the vessel from the captain or vessel owner to set up a tablet and the ER application.

PIFSC has produced an informational pamphlet that can be distributed to the industry and illustrated in Appendix 4: ER informational pamphlet.

ER Setup and Training

PIFSC staff have noted that incorporating one-on-one, hands-on training immediately after setup helps captains successfully transition from paper log reporting to electronic submissions. The possibility of holding outreach and training classes has also been noted, but no classes have been held to date due to the preference of one-on-one training. The inventory of tablets ready for deployment and deployed tablets are kept track in a shared Google sheet ER Vessel List.

VMS Unit Activation for E-Log Data Transmission

A vessel's VMS unit account must be activated for data transmission before it can be used for sending e-logs. PIFSC contacts either Woods Hole Group (WHG) or Skymate for account activation.

In addition, Skymate VMS's must be running software version V2.201909281155 (September 2019) or greater before ER can be used on that vessel.

Tablet Setup

Initial tablet setup is done by PIFSC staff in the office. This setup includes the following:
Charge tablet and setup Android OS

1. Set time zone to HST and make sure date/time is accurate

2. Update OS and apps if necessary
3. Log device MAC address and serial number
4. Inventory device in Tablet Manager application
5. Adjust tablet settings to optimize tablet for ER (adjust display, adjust keyboard size, turn off predictive text, turn off screen auto-rotate.)

Install ER applications (ER Launcher, ELog-It, and WHG VMS Scanner)

1. Download Launcher Library files (Quick Guide, User Guide, Fish and Protected Species ID guides, etc.)

Setup ER applications

1. Lock tablet home button to Launcher application
2. Enter information into Tablet Manager application and print user deployment sheet with vessel and user information.
3. Setup vessel and user information
    a. Permit number (Vessel ID)
    b. Vessel name
    c. CML (User)
    d. User password
    e. Transmission type
        i. RockStar (no longer applicable)
        ii. WHG (Leo/Thorium, Triton)
        iii. SkyMate (not active yet)
4. Activate user (requires a code generated from a separate application used by PIFSC staff)
5. Log in to application and check for updates while connected to a secure Wi-Fi access point
6. Enter test trip (Depart port and return to port forms only; to be used to test transmission upon setup at the vessel)

Connectivity and Testing

Set appointment (if possible) with user and meet at the vessel.

Connect tablet to VMS

1. WHG units – require a Bluetooth pairing PIN
2. SkyMate units – Wi-Fi; not implemented yet

Test transmission with previously entered test trip. If successful, proceed to user training.

User Training

Walk user through a single set trip. Allow user to submit multiple test trips if requested.

PIFSC staff have also successfully assisted captains on HILLE vessels that are California-based in remote setup for the following situations:

1. Captain met with PIFSC staff in Honolulu and took a tablet back to San Diego. The captain was able to successfully pair with the VMS unit and send test trips with assistance from PIFSC via phone.
2. Captain added self as a user on the tablet with assistance from PIFSC via phone.
3. Following the replacement of a vessel's VMS unit, captain was able to change the VMS unit type selection in the application and pair to the new unit.

Back-end Data Retrieval and Processing

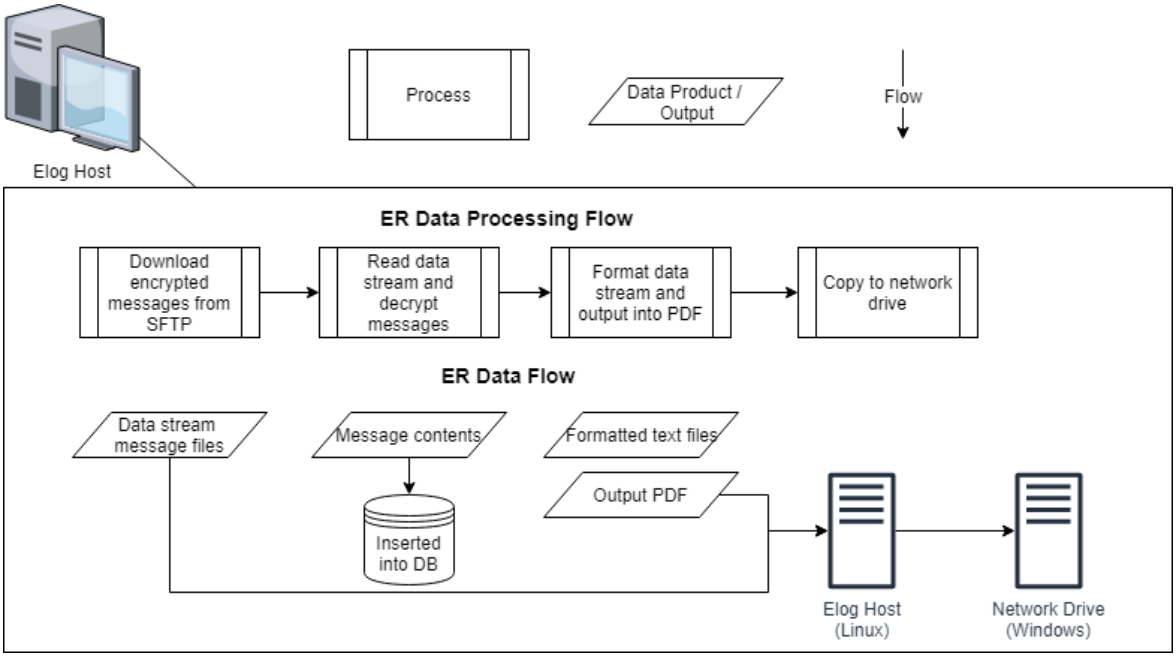

Figure 2: Back-end Data Processing Flow

Back-end Data Stream Application

In 2018, PIFSC contracted Point 5 Solutions to develop a back-end data stream application to download, read, and decrypt the incoming ER data. The application is written utilizing Python 2.7.x and Oracle PL/SQL. Limited support from the contractor is available, but PIFSC staff now maintains any updates and/or bug corrections for this application.

All data received are downloaded and entered into the Oracle database at PIFSC. Process and data flow are illustrated in Figure 2. After data are copied onto the network drive, these data follow the same data processing as the paper logs for consistency.

Error Handling

The current data stream application has built in error logging and handling. Also, email notifications are sent when one of the following occurs:

1. Incomplete eForms are identified by the back-end data stream application and not all parts of the message are received.
2. Duplicate trip or log ID's are detected for processing.
3. Data cannot be processed due to other errors.

Any of the above errors must be reviewed by PIFSC staff and handled accordingly. PIFSC is exploring additional methods to automate the process in the future.

Sustainable Development and Technical Support

Access to Logbook Data by Authorized Personnel

Logs should be readable by authorized people, such as Coast Guard personnel when boarding a vessel. Currently there is no user login set up for the Coast Guard as operators are requested to use their login and show completed elogs to the Coast Guard.

Application, Documentation, and Encryption Key Updates

Development and Testing

Potential Development Needs:

1. Transmission via new type-approved VMS units
2. Additional features such as:
    a. Allow correction submission
    b. Date/Time calculations (time zone changes based on location).

Pier 38 facility and infrastructure will serve for encryption key management. Development will occur for California and American Samoa-based vessels after the Hawaii permit holders have ER.

Dissemination

Updates to the software and encryption key will be available for vessels landing in Honolulu via an access point at Pier 38 office.

Contingency Plan

Incomplete Data

Each E-log trip is checked for missing sets and trip information as data are received and also when it is processed. When necessary, the ER team will arrange to meet with captains to resend data.

Tablet or Application Malfunction

In the event that the tablet and/or application malfunctions:

1. The user *must* record the remainder of the trip activities using paper logsheets. Upon returning to port, the user should alert PIFSC staff that they will be submitting paper logs for the trip and submit them within 72 hours.

VMS Malfunction

In the event of a) VMS equipment failure *but* the tablet and application are still functioning OR b) the tablet will not transmit data due to no connectivity to the VMS:

1. The user may opt to continue entering ER data. Upon returning to port, the user will need to submit eForms via Wi-Fi. With this option, the user will need to enter fishing locations manually since they cannot be retrieved from the VMS.
2. The user may opt to record the remainder of the trip activities using paper logsheets. Upon returning to port, the user should notify PIFSC staff that they will be submitting paper logs for the trip and submit them within 72 hours.

Technical Support Plan

PIFSC ITS Support

The ER team relies heavily on the PIFSC ITS division to support the maintenance of the database, application, and sFTP servers and any connectivity to those devices.

PIFSC compiles a list of comments and suggestions from Elog-It users and have incorporated many changes to make the user experience better. This line of communication also keeps users engaged and valued when modifications are made with Elog-it software updates.

Support to the Industry – See Technical Support Plan in Appendix 5
PIFSC email address: pifsc.elogsupport@noaa.gov
Dedicated ER phone number – (808) 725-5604

Access to near real-time fishery information by permit holders

Discussions with industry indicated that fishers (permit holders) were interested in receiving near-real time elog data submitted by ER from their vessels. PIFSC has re-compiled logsheets that are submitted each fishing day. PIFSC has been investigating the feasibility of hosting data on a secure website that is accessible by permit holders. PIFSC had recent (May 2020) discussions with NMFS Science & Technology, S&T who indicated that S&T could offer assistance in establishing a secure website. PIFSC will continue discussion with S&T for hosting the website and providing secure data transfer to incentivize the use of voluntary ER.

References

FRMD 2019b. The Hawaii and California-based Pelagic Longline Vessels annual Report for 1 January - 31 December, 2018. 21 pages. https://www.fisheries.noaa.gov/resource/data/hawaii-california-longline-logbook-reports-2018-0

FRMD 2019b. The American Samoa Longline Limited-entry Fishery Annual Report 1 January - 31 December, 2018. 12 pages. https://www.fisheries.noaa.gov/resource/data/american-samoa-longline-fishery-logbook-summary-reports.

NMFS 2015. NMFS Pacific Islands Region Electronic Reporting and Electronic Monitoring Implementation Plan. January 2015. 33 p.

NOAA Pacific Islands Fisheries Science Center. 2009, Electronic Logbook Certification Guidelines For Logbook Reporting in Pacific Island Fisheries, Version 1.7, June 11, 2009, PIFSC, 1845 Wasp Blvd, Building 176, Honolulu, HI 96818.