Mercy Ships Cargo Day, 2022

FOUNDATION TO INFORMATION SYSTEMS

SkyFlow

A New Era to Warehouse Management

Presented by Group 5:

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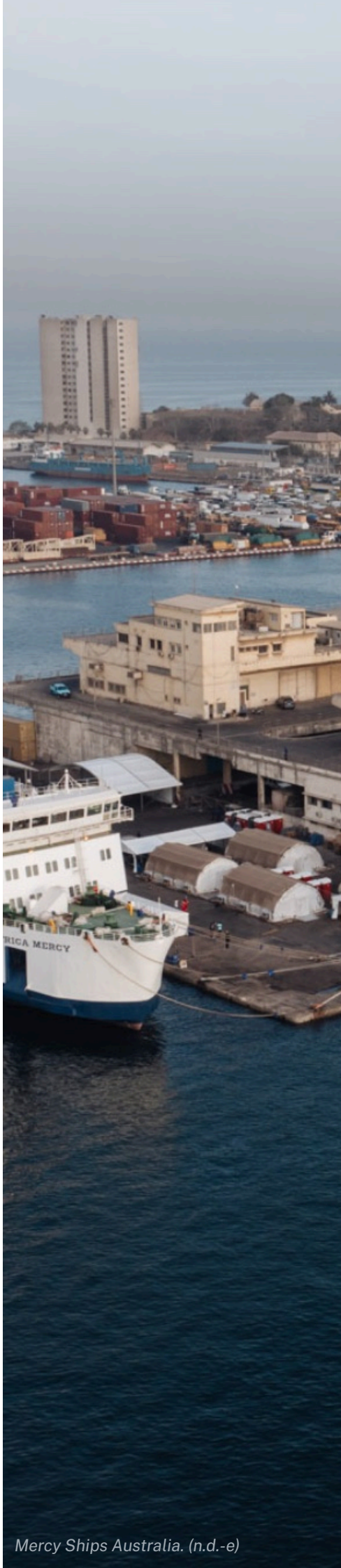


Mercy Ships Australia. (n.d.-e)

Mercy Ships Australia. (n.d.-e)

EXECUTIVE SUMMARY

This report does a comprehensive analysis of Mercy Ships Australia's inventory management system, focusing on the operational challenges and strategic improvements needed to support its humanitarian mission. Mercy Ships is a global nonprofit organisation operating hospital ships to deliver critical medical services to underserved regions. The organisation currently faces significant inefficiencies in managing medical supply inventories, particularly in expiry date tracking and data accuracy. Mercy Ships currently use Excel and Monday.com both of which lack integration and real-time monitoring capabilities. These limitations result in increased risks of expired supplies, operational delays and donor mistrust. The manual tracking of expiration dates which is prone to human error and compromises patient safety is a crucial issue for the organisation.

This report proposes the implementation of SkyFlow, a centralized digital warehouse management system to address the critical issue of inventory management. SkyFlow systems has automation, QR code tracking and real-time expiry alerts to streamline inventory management. The system has user-friendly interfaces tailored to both warehouse assistants and supervisors, ensuring accessibility for Mercy Ships' staff with limited technical expertise. Through detailed user personas, system narratives and interface prototypes, this report outlines how SkyFlow can improve traceability, reduce waste and support compliance for Mercy Ships Australia. The importance of a scalable, integrated system in humanitarian logistics is highlighted through comparative analysis with other NGOs including Médecins Sans Frontières and the IFRC. At its core, this report proposes a practical affordable inventory system that will help Mercy Ships to achieve its mission, while ensuring an increased volume of donated supplies can be accepted, tracked and used effectively to save precious lives.

1.0 BACKGROUND INFORMATION

1.1 Mercy Ships and it's Operational Environment

Mercy Ships is an international humanitarian organisation that operates hospital ships to deliver free, and specialised medical services to developing countries (Mercy Ships Australia, n.d. -a). Their mission has successfully improved the lives of over 2 million people, particularly in Sub-Saharan Africa and the Asia-Pacific region (Mercy Ships Australia, n.d.-a; n.d.-b). Receiving over $1.66 billion in donated services, MS has completed over 100,000 surgeries through the dedication of volunteer medical professionals and partnerships with local governments (Mercy Ships Australia, n.d.-c; n.d. -d).

Given the current scale of the humanitarian efforts, Mercy Ships operational environment functions through highly complex interactions: highly mobile maritime hospitals, fluctuating volunteer workforces, limited infrastructure in host nations, and the logistical challenges of delivering medical aid to ports stationed in more than 56 countries (Mercy Ships Australia, n.d.-e). Operating in these environments, highlights the significance of requiring an efficient, transparent and compliant logistics system, particularly regarding biomedical inventory, given the demands of both international humanitarian law and national health ministeries (Who Health Organisation [WHO], 2023; MSC Foundation, n.d.).

1.2 The Critical Role of Biomedical Inventory Management

A sufficient biomedical inventory system underpins patient safety, operational continuity, and regulatory compliance throughout the entire supply chain. In the context of Mercy Ships, this involves overseeing the entire life cycle of donated medical supplies, from shipment to port logistics to onboard storage and deployment in field hospitals. These supplies can range from temperature-sensitive pharmaceuticals to surgical instruments and diagnostic equipment; all of which needs to be tracked, handled, and deployed with precision (Cheng et al., 2021). Many of these items are subject to strict expiration timelines and storage constraints; lapses in inventory oversight at any stage can result in treatment delays, increased infection risk, or adverse outcomes (Kshetri, 2018).

In humanitarian settings, inventory wastage can exceed even 30% due to expiration, misallocation or damage (Transparency International, 2022). This can jeopardize not only patient outcomes, but also donor trust and regulatory credibility. Moreover, expired medical supplies carries severe reputational and ethnical consequences, particularly when serving populations in resource derived environments (WHO, 2021).

1.3 Stakeholder Analysis

Days	Agenda
Warehouse Staff	Require intuitive tools to be used in for data entry and streamline workflow.
Medical Staff	Depend on the timely availability of supplies for life-saving medical supplies that are high quality.
Management Teams	Depend on having accurate data to inform decisions and satisfy audit requirements.
Donors	Provide supplies and also ensure the ethical use of products across the supply chain.
Volunteers	Variably trained individuals who require user-friendly interfaces and structured onboarding.

Table 1: Overview of the Stakeholders in Mercy Ships

Mercy Ships Australia, n.d.-b

1.4 Current System Challenges and Risks

MS Australia currently relies on a combination of Excel spreadsheets and Monday.com to manage donation supplies and communicate expiry related alerts. These systems, whilst functional, are not integrated, which can result in fragmented workflows and limited visibility across different teams. As a result, the potential for optimal coordination of resources, particularly in relation to rapid decision making in dynamic and resource-constrained environments, is limited. Inventory resources are manually updated, making the process prone to errors and delays, and increasing the risk of understocking or wastage due to expiry. Collectively, these constraints reduce responsiveness from operations, compromise data integrity and can make it difficult to meet compliance requirements from both donors and regulators.

1.5 Downstream Impact Analysis

The implications of poor inventory management especially in healthcare settings can ripple across patient care, operations, finances and stakeholders trust. If expired or compromised medical supplies are used, patient safety is directly threatened, potentially leading to ineffective treatments or surgical complications (WHO, 2021). Operationally, the lack of proactive inventory control results in reactive logistics, inflated shipping costs, and increased staff workload. The impact is also severe financially as studies estimate that 30-40% of stock value can be lost annually due to expiry-related waste in poorly managed systems (Kshetri, 2018). This inefficiency can not only exhaust resources but also undermine the confidence of Mercy Ships Australia’s donors and regulators, who expect transparency and accountability in how contributions are used.

A robust inventory system enhances compliance, reduces redundancy and improves tax reporting by delivering a clear return on investment (ROI) by preserving stock value and showing responsible stewardship of donor funds (Rachmania & Basri, 2013). Additionally, safeguarding inventory and supply chain data is critical, as it is common in the modern world for breaches or data loss to compromise operational integrity and erode trust.

1.6 Scalability and Future Risks

With the growth of biomedical inventory volumes and complexity, Mercy Ships faces increasing risks if current systems remain the same. Not having a scalable infrastructure can result in financial losses, operational delays and regulatory non-compliance for the organisation (Nuvolo, 2022). To support future growth, integration with broader ERP and supply chain is crucial, enabling real-time visibility, control and traceability (Leslie, 2025). Each of the stakeholder groups is impacted differently. Warehouse staff require intuitive tools to reduce manual entry while medical teams rely on timely, accurate supply availability. Mercy Ships management requires centralised data for strategic decisions and audits, whereas donors and regulators expect transparency and ethical sourcing. A responsive inventory system would offer tailored access, easy-to-use interfaces and automated alerts to meet these diverse needs (Muga et al., 2021). Without modernisation of its current systems, Mercy Ships Australia risk inefficiencies that could compromise its growth, mission and stakeholder trust.

1.7 Comparative Analysis of Non-Government Organisations (NGOs) Inventory Systems

Médecins Sans Frontières (MSF)

MSF utilizes UniField, a custom-developed Enterprise Resource Planning (ERP) system designed to integrate finance and supply chain operations across its global missions. UniField is a fully functional ERP relying on both:

- Local autonomous installations allowing for offline use
- A central synchronization server allowing for data exchange between installations whenever an internet connection is available.
- As of recent reports, UniField is deployed in 60 countries and more than 400 locations with over 3,800 active users. (Head of ERP Support and Development – UniField, 2024)

International Federation of Red Cross and Red Crescent Societies (IFRC)

The IFRC employs a decentralized approach to biomedical inventory management, leveraging the capacities of its 191 National Societies.(IFRC, n.d.). Decentralized systems allow for rapid adaptation to changing circumstances on the ground. Differences in resources among National Societies may affect the uniformity of inventory management capabilities.

Each organisation employs distinct strategies for biomedical inventory management, tailored to their operational models and the contexts in which they work. MSF's UniField offers an integrated, standardised approach suitable for diverse field conditions. The IFRC's decentralised model leverages local knowledge and autonomy, promoting flexibility and community engagement.

1.8 Rationale for a Specialised Mercy Ships Information System

A inventory system is necessary for time efficiency. It supports the underlying mechanisms that ensure the safety and reliability of supplies and uphold the integrity of the humanitarian mission. Given the current challenges that are faced by Mercy Ship and their dynamic environment such as rotating volunteers, limited onboard storage and high-pressure environments - there is a need for seamless coordination between onshore supply hubs and ship-based clinics (Merci Ships, 2019).

A specialised system will need to be cost-effective, easy to learn and compatible with current processes. It is important that the system represents accountability; that every product whether it is surgical gloves or a life-saving drug is managed with transparency, safety and integrity. As such, Mercy Ships reinforces their humanitarian values and maintains it’s donor confidence.

Mercy Ships Switzerland, 2021

2.0 PROBLEM STATEMENT

Mercy Ships Australia is currently facing a critical challenge in effectively monitoring the expiration dates of medical supplies, creating a potential risk of wastage. The current manual tracking system is prone to human error, which can make it difficult to identify and act on impending expirations. As a result, expired supplies can remain in inventory unnoticed, risking their accidental deployment and compromising patient safety.

The lack of an effective system to monitor expiration dates becomes a flaw of precise inventory management, making it difficult to optimise the distribution of resources and ensure that medical supplies are used before they expire. A particular point of contention lies at the entry phase of a shipment, where products first arrive at the warehouse. This point is crucial, as it represents the earliest opportunity to capture expiration data and to initiate a reliable tracking process.

3.0 USER PERSONA

To further highlight the challenges that are faced by current manual expiration tracking, we are introducing *Janine Hargrove*, **a warehouse staff member** and *Sophia Williams*, **a warehouse supervisor** to embody the current experiences and frustrations faced by staff in their day-to-day operations.

3.1 Janine Hargrove (Warehouse Assistant)

Biography:

Janine Hargrove is a 28-year-old **Warehouse Assistant** who transitioned from factory work into the field of humanitarian logistics. Though new to digital inventory systems, Janine has shown a strong willingness to learn. Her role focuses on **unpacking, categorising, and preparing medical supplies** for shipment on Mercy Ships. She's deeply committed to the mission but is often slowed down by inefficiencies in manual tracking processes.

Primary Goal:

Ensure all medical supplies are accurately recorded, tracked, and rotated in a timely manner to ensure expiration-related waste to support, efficient distribution.

Supporting Goals:

- Efficiently receive and unpack donations.
- Organise supplies clearly with accurate records, particularly around expiry dates.
- Manually enter data into tracking systems.
- Communicate stock and expiry issues with warehouse supervisors.
- Support the shift to a low maintanence, intuitive expiry tracking system.

Key Challenges:

Difficulty tracking expiration dates with current manual systems, increasing the risk of distributing expired or soon-to-expire items.

Supporting Challenges:

- Supplies arriving without clear labeling or pre-attached expiration data.
- Inventory records not updated in real-time, creating blind spots in expiry monitoring.
- Limited access rights to edit inventory data makes it difficult to act quickly when issues are spotted.
- Visual tools (e.g, spreadsheets) lack clarity and are prone to human error.
- Existing systems are not tailored for quick expiry visibility, especially for non-technical users.

Motivations:

Janine is driven by the humanitarian impact of her work. She takes prides in knowing that her role helps save lives. The chance to grow her digital and technical skills is a major motivator, especially if it leads to smarter ways to prevent critical waste due to expired supplies.

Needs:

- A simple, visual system to track and alert for expiring items.
- A standardised, easy-to-follow method for labelling and sorting supplies expiry date.
- More inclusive access controls to allow trusted staff to update expiry records directly.
- A reduction in manual checking tasks to save time and reduce stress.
- A user-friendly interface tailored to low-tech users that supports consistent expiry monitoring.

Image from Canva

3.2 Sophia Williams (Warehouse Supervisor)

Biography:

Sophia William is a dedicated and experienced **warehouse supervisor** supporting the global operations of Mercy Ships. Although she doesn’t work on the ships directly, her behind-the-scenes role ensures that medical supplies arrive safely, on time, and in good condition. From local warehouse oversight to international deliveries, Sophia’s careful management prevents waste, ensures compliance, and supports the work of frontline medical staff.

Primary Goals:

Ensure that no expired or soon-to-expire medical supplies are missed, misused, or wasted, so that all field operations can run safely and without delay.

Supporting Goals:

- Prevent unnecessary waste due to system or human error.
- Improve data accuracy by catching manual input errors.
- Streamline the workflow for tracking, validating, and updating stock information.
- Support Mercy Ships' mission by ensuring the smooth delivery of supplies.
- Maintain a high level of trust in the inventory system among field teams.

Key Challenges:

The key challenge is the balancing of operational efficiency with data accuracy in a high-stakes and time-sensitive environment.

Supporting Challenges:

- Managing false-positive expiry flags caused by manual data entry errors.
- Ensuring alert accuracy without slowing down warehouse operations.
- Maintaining consistency across global teams with varying levels of system expertise.
- Balancing operational demands with the need for careful data validation.

Motivations:

Sophia is driven by her desire to help others. She believes that well-managed inventory isn't just about logistics, it's about enabling life-saving work. She wants systems to work for people, not the other way around. Every improvement she makes is meant to support the mission and reduce stress on field workers.

Needs:

- A single system that connects all supply locations in real time.
- Easy-to-read dashboards and reports.
- Smart alerts to tell teams when supplies are running low or about to expire.
- A training guide that helps new staff learn systems quickly.
- A better way for teams to chat and plan inside the system without long emails.

Image from Canva

4.0 SYSTEM NARRATIVE

To ensure the success of the proposed inventory tracking system, SkyFlow, it's important to understand how it will be integrated into the daily routines of key user groups, in this case, it is particularly relevant to warehouse workers. This section presents a narrative that illustrates **how the system will support real people in real roles.**

The following story focuses on Janine again, recounting her a day in her life to demonstrate how the system simplifies her once labor intensive tasks and it's seamless transition into her workflow. Transforming the error-prone manual system into a streamlined and improved one.

4.1 Janine Hargrove (Warehouse Assistant)

At Mercy Ships Australia's central warehouse, Janine Hargrove, a dedicated Warehouse Assistant, plays a crucial role in ensuring that every donated medical supply is safe, traceable, and used before its expiration. Her daily routine has evolved thanks to the implementation of a digital inventory monitoring system designed to address critical flaws in the former manual process, specifically, the lack of reliable expiry tracking at the entry phase of shipments.

When a new donation shipment arrives, Janine begins by checking each item's expiration date. If any unit is marked to expire in under six months, she rejects the item, preventing it from entering the inventory. This early-stage screening, supported by automated decision rules, ensures expired or near-expired products never move further in the process, a core solution to the problem of unnoticed expiry.

For eligible supplies, Janine receives and unpacks the shipment. She scans each item's manufacturer barcode, which triggers the system to generate a unique internal QR code. This code is printed and attached to the item, linking it to a digital record that Janine completes by entering key data: expiry date, product type, and batch number (optional), through a simple, guided interface.

Once submitted, this data is immediately stored in the warehouse's centralized system, which begins real-time expiry monitoring. The item is then sorted into an appropriate storage zone, priority processing if the expiry is near, or standard storage if the shelf life is longer. This intelligent classification ensures that inventory turnover aligns with expiry timelines, minimizing waste and protecting patients.

In the background, the system continuously monitors the shelf life of all items. When a product's expiry date drops below the six-month threshold, it is automatically flagged in the system. This triggers an alert, which is sent via app notification to the supervisor. These proactive warnings enable timely action, such as prioritizing the item for immediate use or removing it from inventory, effectively addressing the original challenge of unnoticed, expired stock.

Janine appreciates the system's user-friendly interface, which features clear icons, intuitive prompts, and straightforward navigation. Despite her limited tech background, she quickly adapted thanks to a built-in interactive training module and an accessible FAQ section. This support gives her confidence and allows her to work efficiently, even during peak donation periods.

Diagram 1: Janine Hargrove's comic-style story boarding (illustrated by ChatGPT)

4.2 Sophia Williams (Warehouse Supervisor)

Sophia William is 45 years old and has over 15 years of experience in warehouse work. She now uses her knowledge to support Mercy Ships. Even though Sophia doesn't work on the ships, she plays a big role in helping them run smoothly.

As a warehouse Supervisor, Sophia takes care of the movement of medical supplies around the world.She handles everything from warehouse work to overseas deliveries. Her job is to make sure that medicines, tools, and important equipment arrive where they are needed — on time, complete, and in good condition. Her goal is simple but important: avoid waste and save time.

Each day, Sophia logs into Skyflow system, the warehouse management application that acts as a central hub connecting inventory data from multiple warehouse locations. Thanks to recent system upgrades, every item that enters the warehouse is assigned a unique QR code. The warehouse team inputs critical data, such as item type, description, expiration date, and batch number (optional), into Skyflow. Once the information is saved, an embedded monitoring rule automatically activates, and the system begins continuously tracking the shelf life of all items in inventory.

One morning, Sophia logs into the system and sees a red expiry alert for WMS-BX2-381299 – Syringes. The system claims the item has only 90 days left, well under the six-month threshold. But when she checks the barcode and supplier docs, she finds the real expiry is December 1, 2025 which is still safe. On the alert screen, she selects "Dismiss", corrects the date on the update screen, and saves it. The system removes the false flag, and the item returns to general stock.

Not long after, a new alert appears for WMS-ZP7-473920 – Tablets (A), flagged with 118 days remaining. This time, Sophia checks and confirms the expiry is correct. She confirms the alert and the system shows 'Alert Confirmed – Priority Flag Maintained', locking the item for urgent use and showing a green success icon. Sophia clicks "Back to Alerts" and keeps reviewing.

his alert–check–act process is part of Sophia's daily work. Her careful checks keep the supply system working well. They stop waste, build trust in the system, and help ensure that medical teams always have the safe supplies they need.
Sophia doesn't just handle logistics, she helps make a difference. Her leadership helps people like James, a staff member on the Mercy Ship, avoid delays from expired items or missing supplies. When James gets what he needs on time, he can focus on caring for patients.

Sophia uses tools like dashboards, expiry alerts, and stock records but her best qualities are her clear thinking, steady work, and care. On her desk is a photo of a young patient with a note that says: "You helped save this life." It reminds her every day that each alert she checks and each shipment she sends is part of something much bigger.
By making sure no expired supplies are missed, Sophia plays a key role in Mercy Ships' mission. She's not just moving boxes, she's helping keep hope alive.

Diagram 2: Sophia William's comic-style story boarding (illustrated by ChatGPT)

5.0 DATA SPECIFICATION AND INTEGRATION

This section presents the data flow diagram (DFD) to illustrate how SkyFlow will support the daily workflow of two key user roles: warehouse workers and warehouse supervisors (refer to diagram 3). The diagram outlines how data is captured, processed and then acted upon to ensure the accurate traceability and tracking of received supplies.

In Level 0, we consider the SkyFlow Warehouse Management System as a whole and only depict the data exchanged between it and external actors (see diagram 3). The warehouse operator sends a Scan Input (manufacturer's barcode) and Item Details + QR Code to the system, which returns an Internal QR Code for the operator to label. When the system detects an expired item, it sends an Expiry Alert to the warehouse supervisor, who reviews it and returns the results to the system with a Flag Decision. With these four data streams, Level 0 precisely defines the boundaries of the system and its external interfaces.

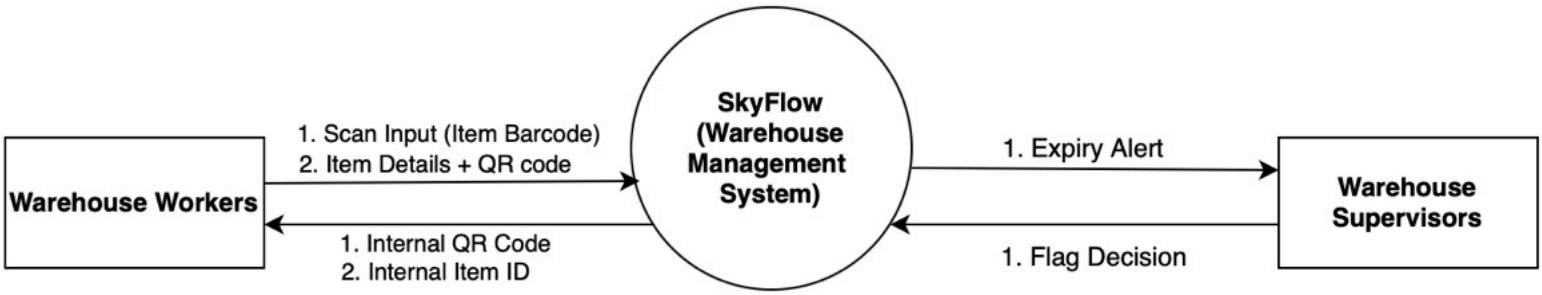


Diagram 3: Level 0 Data Flow Diagram (DFD) of the proposed SkyFlow system

Level 1 takes the above whole and further breaks it down into 8 Processes and 3 Data Stores to show in detail the flow of data within the system (see diagram 4).

- Scan Input enters 1.0 Scan Barcode, generates barcode data and triggers 2.0 Generate QR Code, which sends the Internal QR Code back to the operator. This corresponds to the first set of interactions in Level 0.

- Item Details + QR Code is written to the Data Repository via 3.0 Submit Item Info and 4.0 Save Metadata, which provides the base data for 5.0 Monitor Expiry's timed checks.
- If 5.0 finds that the expiration date is less than 6 months, it sends the result to 6.0 Trigger Alert and pushes an Expiry Alert to the supervisor.
- The supervisor returns a Flag Decision in the 7.0 Validate Alert, which is also recorded in the Validation Records; the 8.0 Update Status then writes the update back to the Data Repository, completing the last data flow in Level 0.

Through this hierarchical description, it can be clearly seen that each external data flow in Level 0 has a corresponding input, processing and output link in Level 1, forming a complete traceable link.

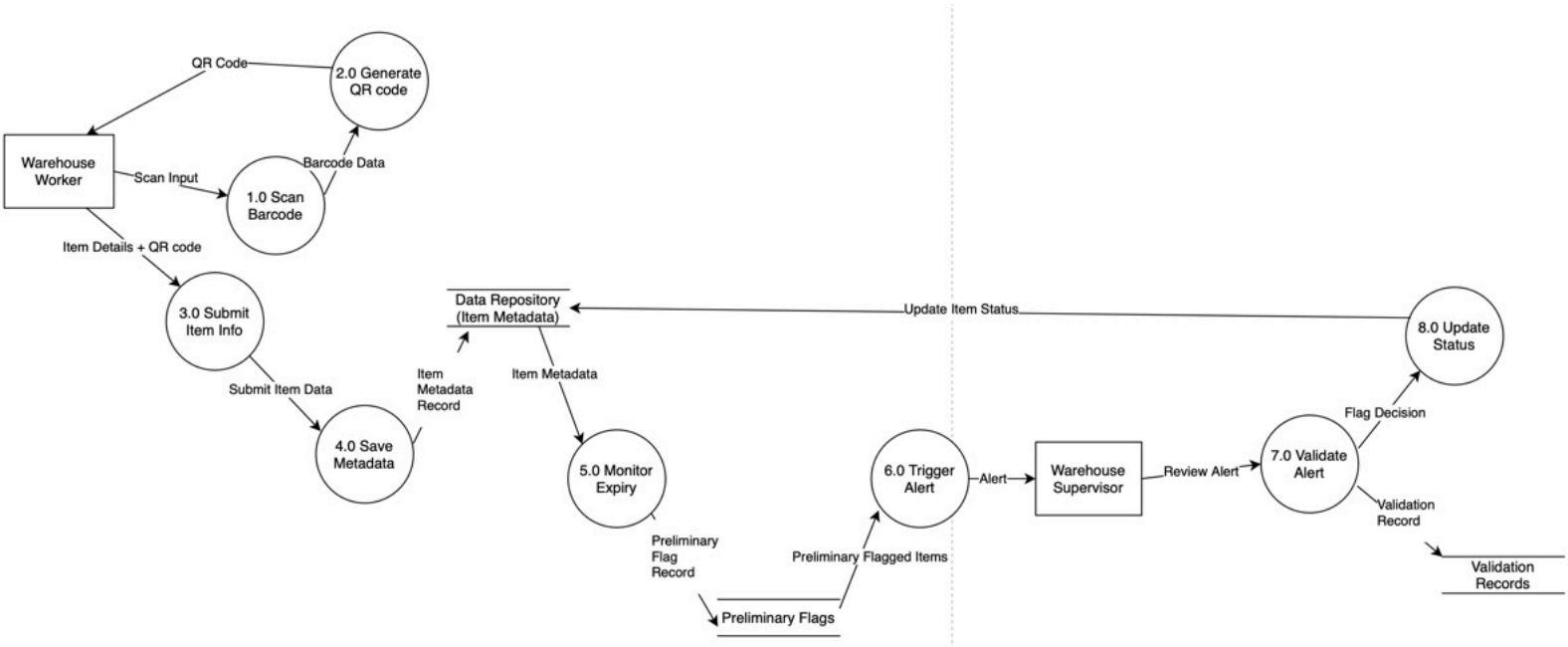


Diagram 4: Level 1 Data Flow Diagram (DFD) of the proposed SkyFlow system

6.0 LOGICAL DESIGN OF PROCESS

6.1 As-Is BPMN

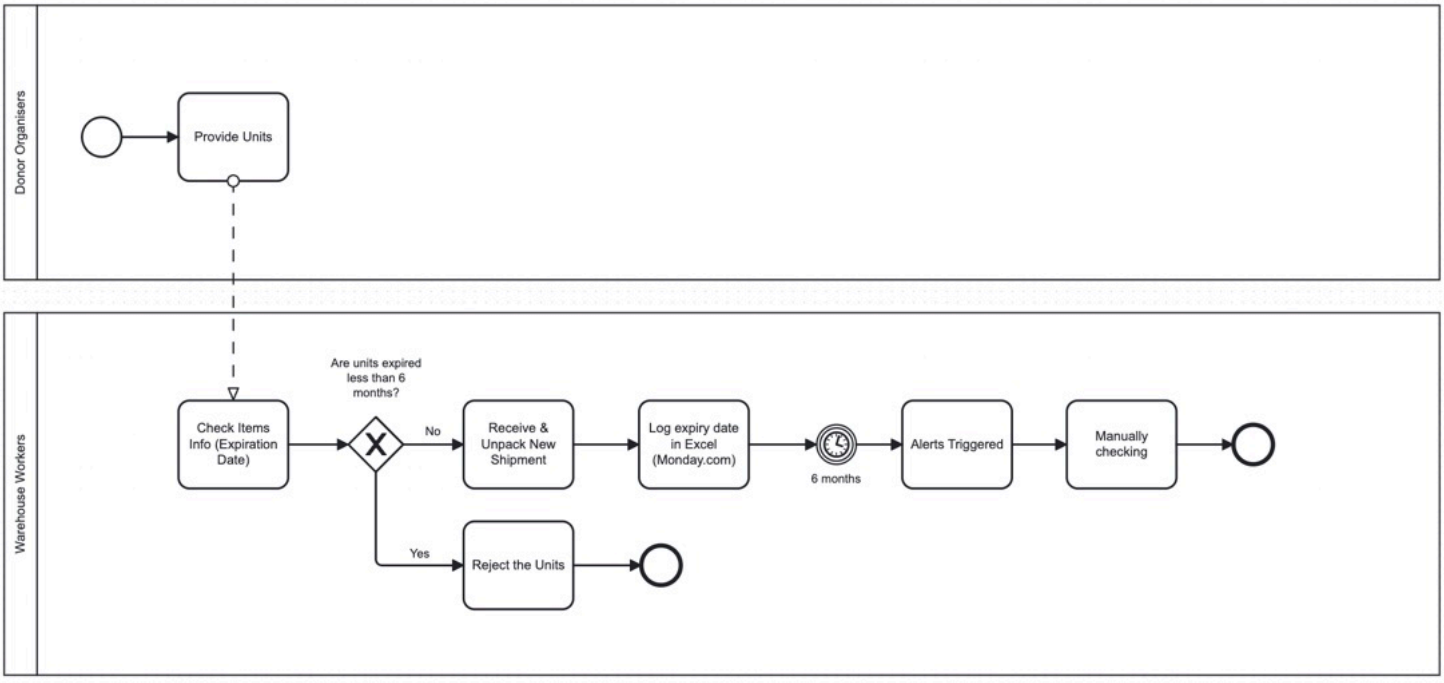


Diagram 5: Business Process Modeling Notation (BPMN) for Current Inventory Management at the Shipment Arrival Phase

To demonstrate the current logical work flow in Mercy Ships Australia, a Business Process Modeling Notation (BPMN) diagram was implemented (see diagram 5). This process begins with the shipment of units from the donor which are then inspected by warehouse workers to verify item information; given the context of this proposal, expiration date is specifically noted.

A decision point follows this inspection: If the units are expired by less than six months, they are rejected, if not, the shipment is received and unpacked. The expiration dates of accepted units are logged into an Excel Sheet (platformed by Monday.com). Subsequently, any alerts regarding the 6-month threshold being reached are recieved, prompting manual checks to ensure quality control.

6.2 To-Be BPMN

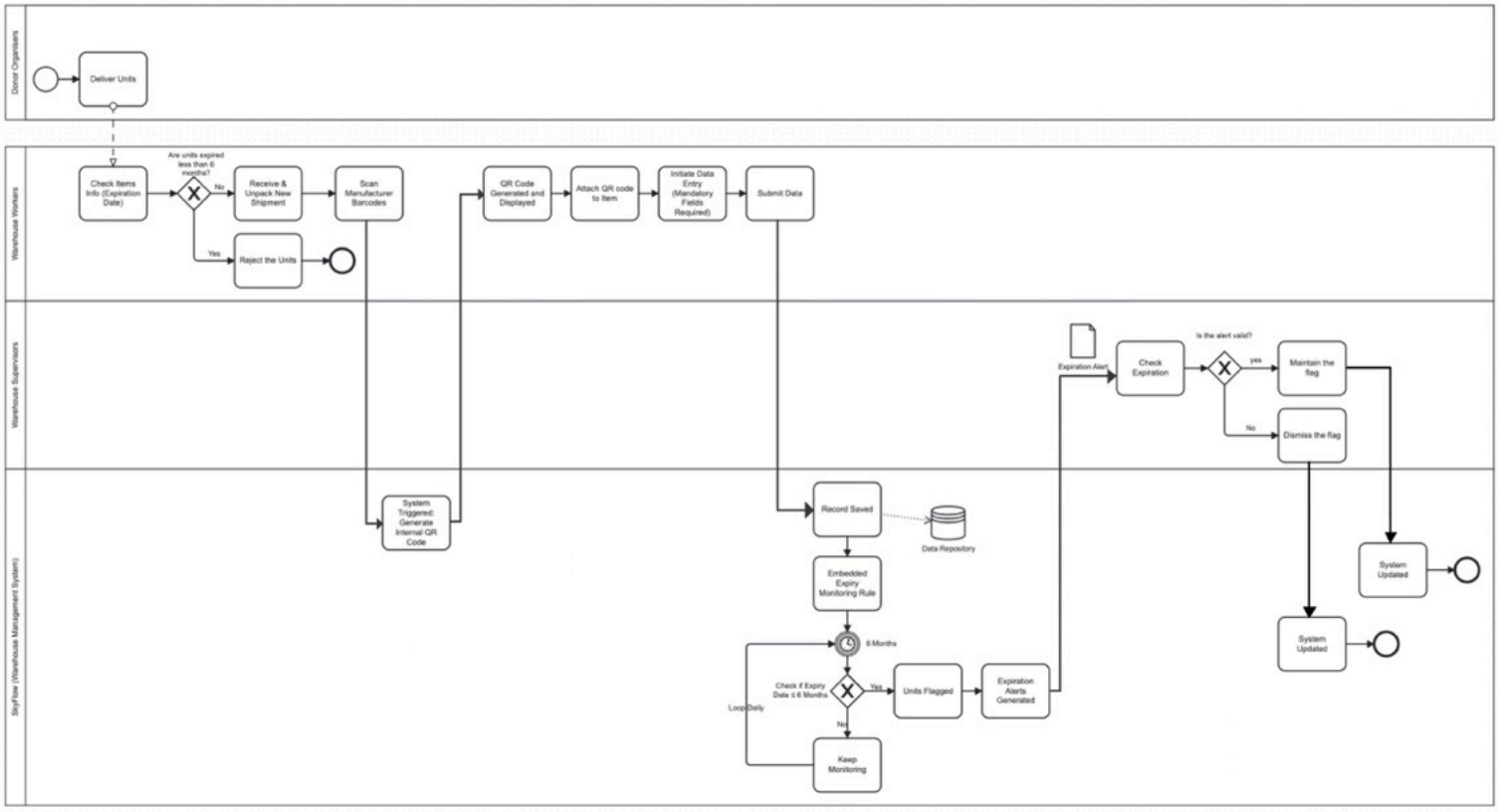


Diagram 6: Business Process Modeling Notation (BPMN) for SkyFlow

Comparatively, to illustrate the proposed SkyFlow system, a BPMN was also used. This one uses 4 swim lanes: Donor Organisor, Warehouse Worker, Warehouse Supervisor and the System itself, SkyFlow.

This begins with the delivery of the units from the donor which are inspected by the warehouse workers, once again focusing on the expiration dates (given the context of the report). If units are expired by less than 6 months, they are rejected. Otherwise the shipment is received and unpacked. The worker scans the manufacturer barcodes, generates and attaches QR codes to items, and enters mandatory data fields before submitting the information.

Simultaneously, SkyFlow triggers the generation of internal QR codes and will embed an expiry monitoring rule once all mandatory fields are complete. This runs daily, checking if any item is within 6 months of expiry. If so, the system flags the units and generates alerts. These alerts are reviewed for validity by the supervisor. Valid alerts maintain the flag, whilst invalid ones will be dismissed, with the system updating accordingly.

Compared to the first BPMN, which is more straightforward in nature with basic expiration tracking, the second BPMN introduces a more advanced and integrated system. The innovation lies in its use of automation and digital tools such as QR generation, mandatory fields and a warehouse management system (SkyFlow) which enhances traceability and effeciency. Whilst the first one relies on manual logging and periodic checks, the second system embeds the expiry monitoring rules directly into the software, enabling dialy augmented checks and real-time alerting. This reduces the risk of oversight, ensures timely action and supports scalability. The layered validation process, involving both system-generated flags and human verification, adds a robust safeguard against errors, making the second BPMN a stable future ready solution.

7.0 INTERFACE

The prototype was designed around the Mercy Ships warehouse management scenario, showing the flow of operations from two different user perspectives: Janine (Warehouse Assistant) and Sophia (Warehouse Supervisor). Each user's interface is customized according to his/her responsibilities, permissions and work scenarios.

In the system's operation, Janine is responsible for entering new inventory and initiating the process, if she submits information containing risky expiration times, the system automatically recognizes them and generates alerts. However, the system does not only monitor Janine's input, it continuously tracks all inventory in the system, regardless of who entered it, and flags any item approaching expiry based on predefined rules.

Sophia logs into the system and reviews alerts in the Unreviewed Alerts category. She validates each case to determine whether the alert reflects a real risk or is a false positive due to data error. If confirmed, the item is marked as "priority", and becomes visible in Janine's interface as a task for operational follow-up.

The whole process forms a clear division of roles: Janine is in charge of entry, Sophia is in charge of judgment and decision-making, and finally Janine performs the processing task. Through the system's automatic identification and real-time feedback, the warehousing operation realizes an efficient closed loop from entry to risk treatment.

This prototype focuses on the core scenario of expiration warning management, emphasizing clear workflow paths, collaboration logic between roles, and the supportive role of the system in information flow.

Note: For User Dashboard from both warehouse worker and warehouse supervisor, we only explained two key features which are "Start New Intake" and "Expiry Alerts". The other two features "Search Items" and "Item History" do not appear as fully developed interfaces in this prototype. The reason for this is that our design and storyline specifically focuses on the Expired Alerts management workflow, which reflects the core problem this project is trying to solve. The search and history views are not central to the alert review logic, we chose not to prioritize their interface design in this iteration.

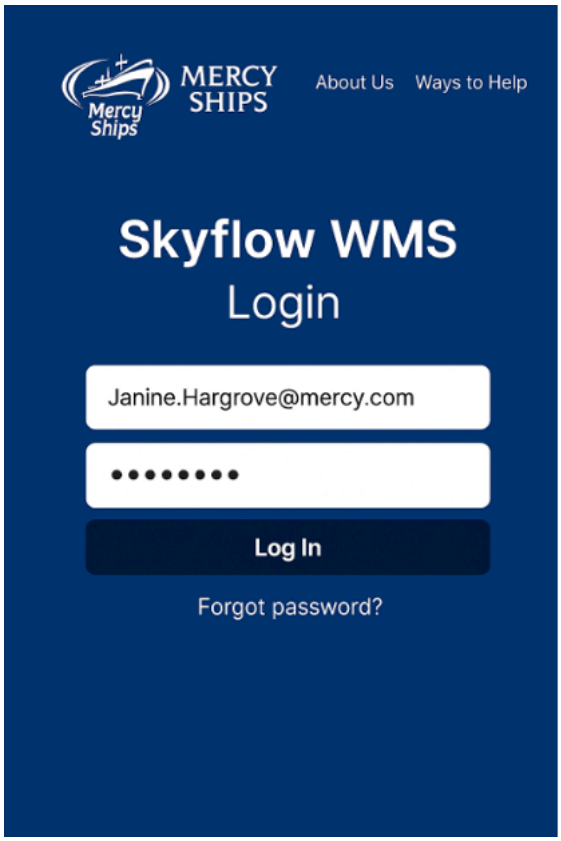
7.1 Janine Hargrove (Warehouse Worker)

UI Screen 1: Login Page

This screen serves as the secure entry point to the Skyflow Warehouse Management System (WMS), allowing only authorized Mercy Ships personnel to access inventory workflows. In this case, the user is *Janine Hargrove*, a warehouse assistant beginning her inventory intake.

Key Features:

- Email & Password Fields: Capture credentials to authenticate users and assign system permissions based on their role.
- "Log In" Button: Initiates secure system access and loads the personalized Dashboard (UI Screen 2).
- "Forgot Password?" Link: Provides a simple recovery mechanism to avoid workflow disruption due to login issues.

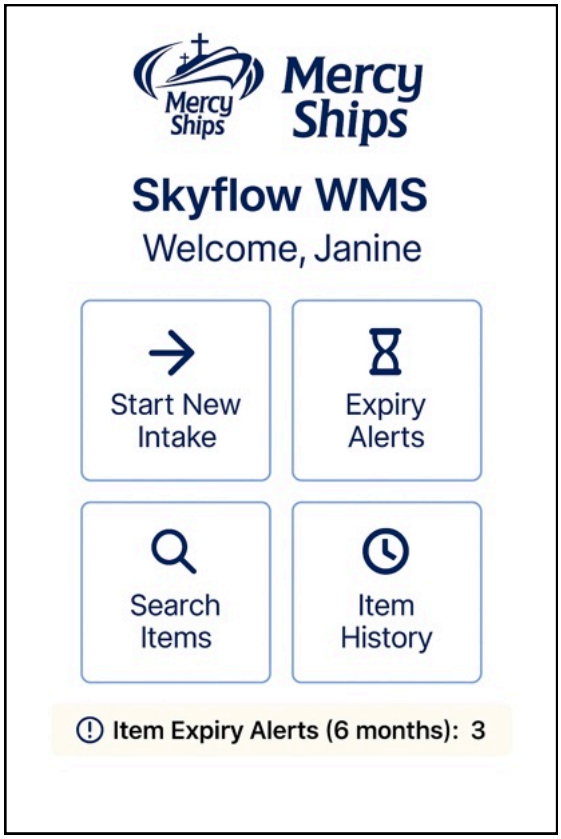


UI Screen 2: Dashboard / Home Screen

This screen appears immediately after logging into the Skyflow WMS and serves as the main navigation hub for warehouse staff. It offers quick access to key inventory functions through a clean, touch-friendly interface optimized for mobile phone use.

Core Functions:

- Start New Intake: Begins the stock receiving process, starting with barcode scanning.
- Search Item: Allows users to look up product details using an internal Item ID.
- Expiry Alerts: Shows items flagged for nearing expiry. Workers can view alerts; supervisors can take action.
- Item History: Displays a log of recent intake activity. Workers see their own entries; supervisors see all.



UI Screen 3: Scan Manufacturer Barcode

This screen initiates the intake process by enabling users to scan the manufacturer's barcode on a product using the mobile device's camera. It is launched when the user taps "Start New Intake" from the dashboard (UI Screen 2).

Functionality: Once the barcode is scanned, the Skyflow WMS automatically links the code to the supplier's product data and immediately proceeds to the next step: generating an internal Mercy Ships QR code. This automation removes the need for manual data entry, ensuring faster and more accurate processing.

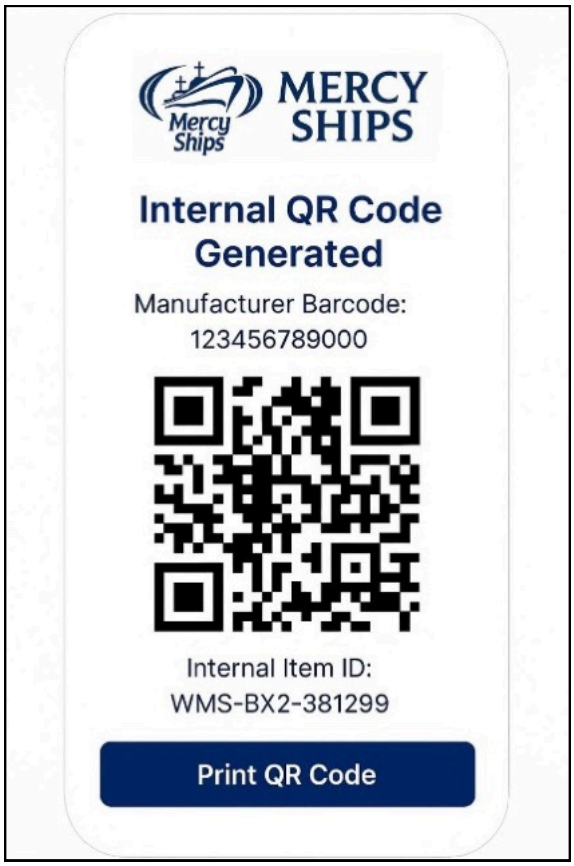
UI Screen 4: Internal QR Code Generated

This screen confirms that the system has successfully converted the scanned manufacturer barcode into an internal Mercy Ships QR code, uniquely identifying the item within the WMS.

Details Displayed:

- Manufacturer Barcode: Displays the original supplier code for reference.
- Internal Item ID: Shows the system-generated item ID (e.g., WMS-BX2-381299) embedded in the QR code.

User Action: Tapping "Print QR Code" generates a physical label to be attached to the item, ensuring end-to-end traceability for all future scanning, tracking, and expiry monitoring steps.

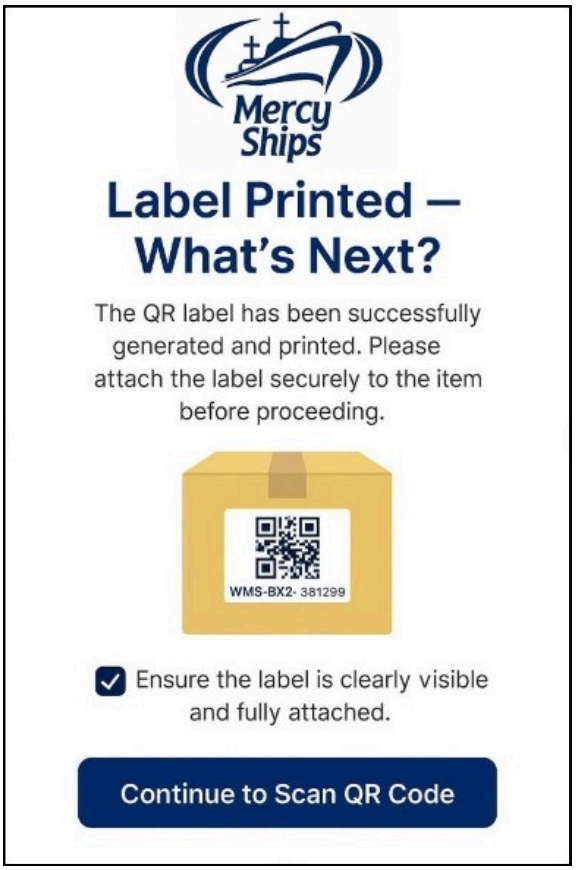


UI Screen 5: Label Attached (Confirmation Step)

This intermediate screen appears after printing the internal QR code and before scanning it. It ensures the QR label is securely and visibly attached to the physical item, maintaining traceability and reducing scanning errors.

Key Elements:

- Instruction Text: Clearly reminds users to apply the printed QR label before proceeding.
- Illustration: A visual cue showing the label properly affixed to a box, reinforcing correct placement.
- Checklist Reminder: Prompts users to verify that the label is fully attached and clearly visible.
- Action Button – "Continue to Scan QR Code": Proceeds to the next step (UI Screen 6) for label validation via scanning.

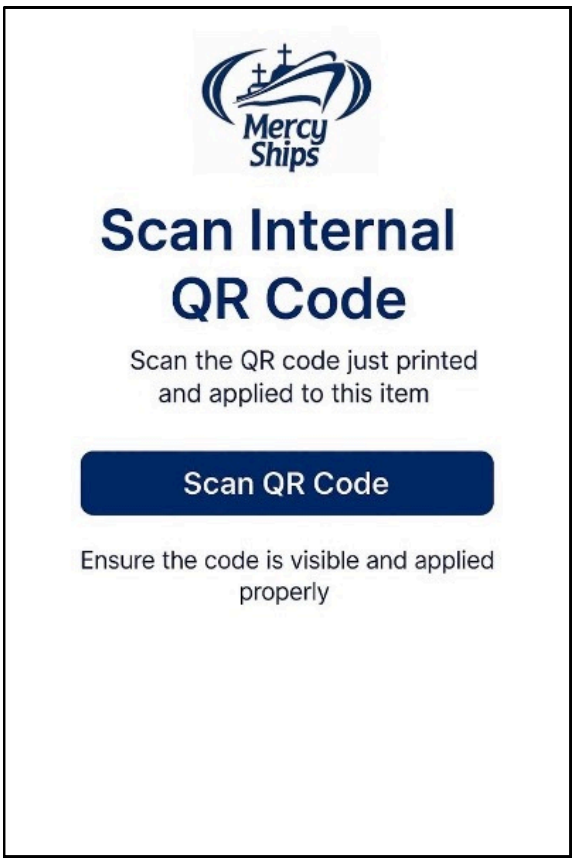


UI Screen 6: Scan Internal QR Code

This screen prompts the user to scan the internal QR code that was just printed and attached to the item. It ensures the label has been correctly applied and is readable before proceeding.

Functionality:

- Uses the device camera to validate that the QR code is visible, legible, and linked to the correct Item ID.
- Confirms the code has been successfully applied to the physical item.
- Upon successful scan, the system stores the QR–item pairing in the WMS.



UI Screen 7: Item Details ➜ Submit

This screen appears immediately after the internal QR code has been scanned. It captures the final product information required to complete the intake process and activate system monitoring.

Functionality:

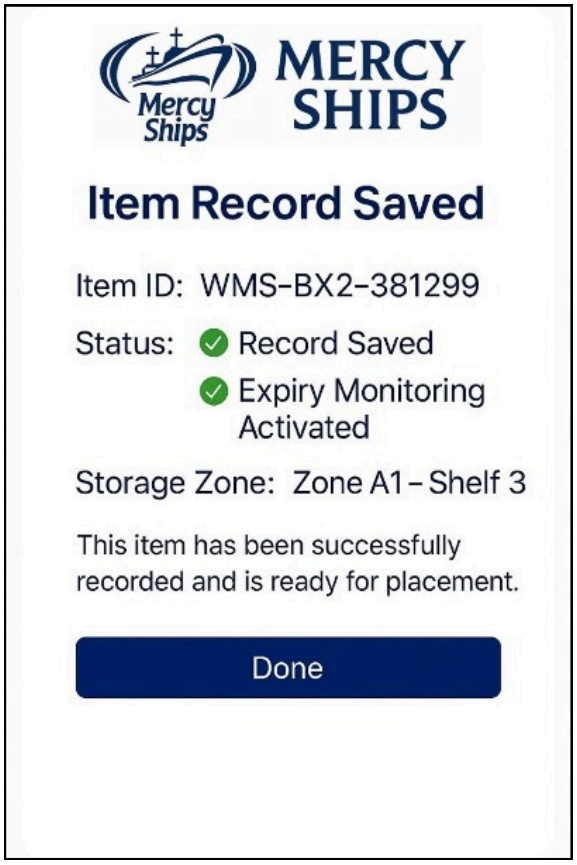
- Internal Item ID: Auto-generated and read-only for traceability (e.g., WMS-BX2-381299).
- Product Type, Expiration Date, Short Description: Mandatory fields that must be filled before submission.
- Batch Number: Optional field, useful for grouping identical units.
- Submit Button: Saves the entry into the WMS, activates FEFO (First-Expired, First-Out) monitoring, and assigns a storage location.

UI Screen 8: Item Record Saved

This confirmation screen appears after the intake form is successfully submitted. It reassures the user that the item has been recorded in the system and expiry monitoring is now active.

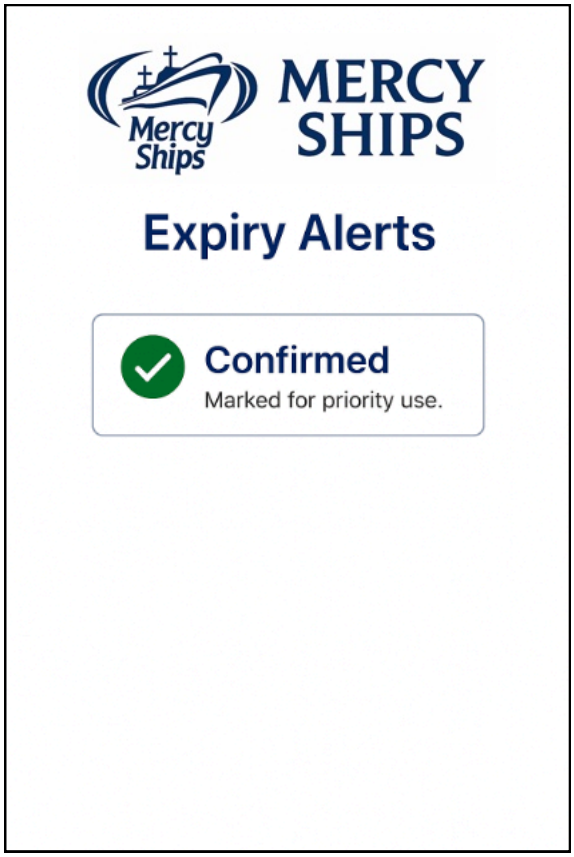
Key Elements:

- Item ID: Displays the system-generated internal code for traceability (e.g., WMS-BX2-381299).
- Status Indicators: Green checkmarks confirm both the record has been saved and expiry monitoring is enabled.
- Storage Zone: Provides the exact location where the item should be placed (e.g., Zone A1 – Shelf 3).
- Done Button: Returns the user to the home screen and signals that the item is ready for physical placement.



UI Screen 9: Expiry Alerts

This screen provides warehouse staff with access to confirmed expiry alerts, which are automatically flagged by the system when an item's expiration date falls within 6 months. These items require priority handling during daily operations. Categories such as Unreviewed or Dismissed are intentionally hidden, reflecting their limited responsibility in expiry validation.



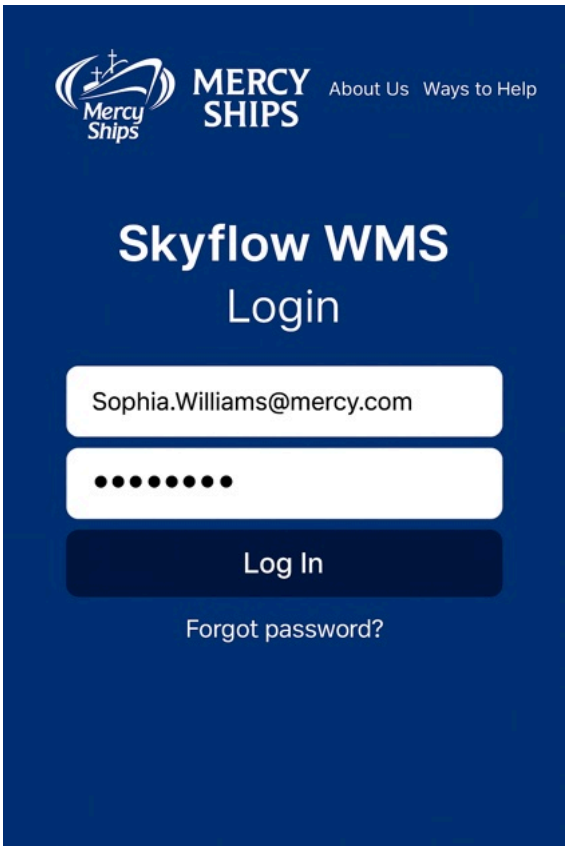
UI Screen 10: Confirmed Alerts

This screen displays confirmed expiry alerts that have been reviewed and approved by a supervisor. It enables warehouse staff to quickly identify items that require priority handling during daily operations. Warehouse workers do not see unreviewed or dismissed alerts, ensuring a focused view aligned with their operational responsibilities while keeping validation tasks reserved for supervisors.

7.2 Sophia Williams (Warehouse Supervisor)

UI Screen 1: Login Page

This is the universal login page for the Skyflow Warehouse Management System (WMS), used by all internal Mercy Ships staff. In this example, the user is *Sophia Williams*, a warehouse supervisor. While the interface remains the same for all users, the system tailors access and functionality based on user roles after login. The screen features a clean, accessible layout optimized for mobile devices.

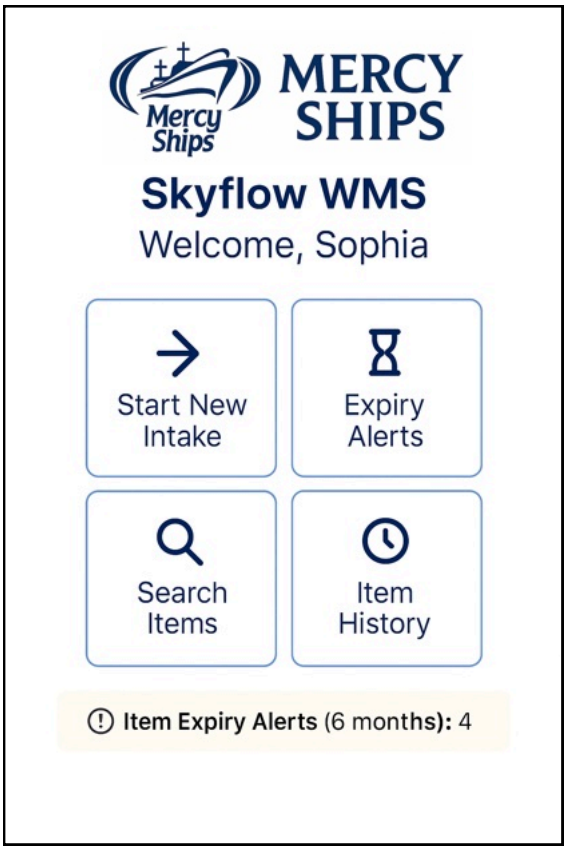


UI Screen 2: Dashboard / Home Screen

After login, the user lands on this dashboard, which offers quick access to essential warehouse functions. While the layout is the same for all roles, available actions differ based on system permissions.

Key Functions:

- Start New Intake: Supervisors have access but typically oversee rather than perform this task.
- Expiry Alerts: Displays items automatically flagged by the system for having less than 6 months until expiry. Supervisors are responsible for reviewing, validating, and managing these alerts.
- Search Items: Allows retrieval of item records using internal IDs. Supervisors can also correct or update inaccurate metadata.
- Item History: Provides a full log of intake activity across all users and timeframes.

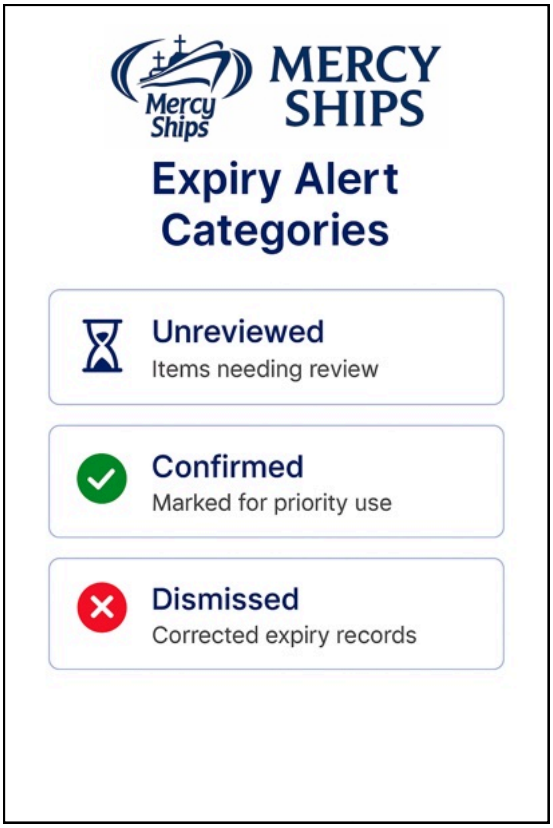


UI Screen 3: Expiry Alert Categories

This screen organizes system-generated expiry alerts into three clear categories, helping supervisors manage them more efficiently. Rather than showing all alerts at once, the interface prompts the user to choose a category based on the alert's review status. This approach reduces clutter, minimizes the risk of repeated actions, and supports a more structured review process.

Alert Categories:

- Unreviewed: New alerts flagged by the system that require supervisor review.
- Confirmed: Alerts that have been reviewed and validated, now marked for priority handling.
- Dismissed: Alerts identified as false positives and dismissed with corrected expiry information.



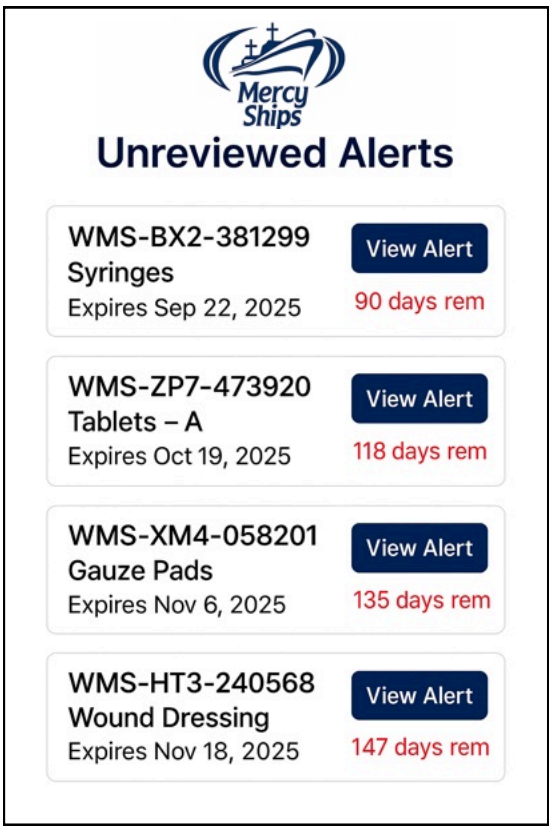
UI Screen 4: Unreviewed Alerts – Pending Supervisor Action

This screen displays unreviewed expiry alerts that have been automatically flagged by the system due to having less than 6 months remaining. These alerts are still unreviewed and require supervisor action to either confirm or dismiss them.

Each alert includes:

- Item ID and Product Name
- Expiry Date
- Remaining Days Until Expiry clearly shown in red to signal urgency
- "View Alert" Button that opens the detailed review screen for validation

This view helps supervisors prioritize time-sensitive items and manage expiry risks effectively.



UI Screen 5: Expiry Alert – False Positive Identified

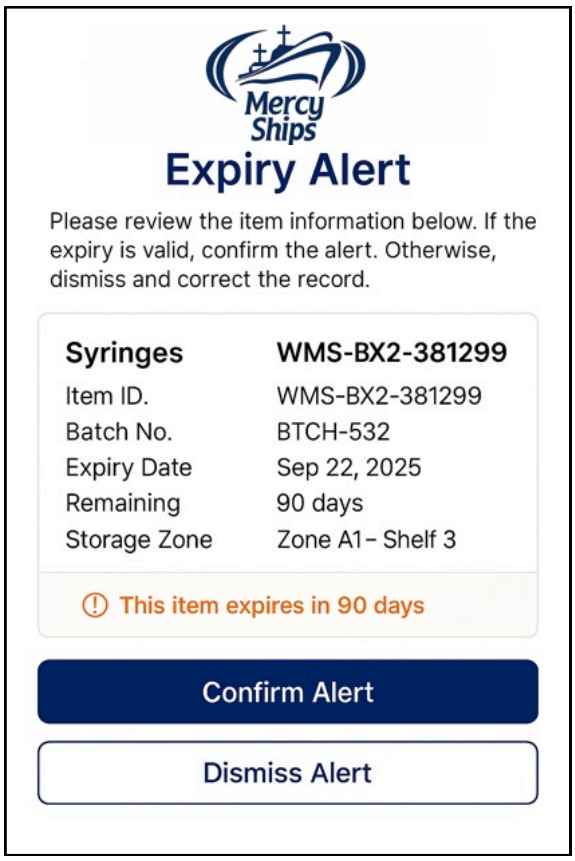
This screen displays an expiry alert for item WMS-BX2-381299 (Syringes), which has been flagged by the system due to having only 90 days remaining until expiry.

Details shown include:

- Item name, ID, batch number
- Expiry date and remaining days
- Assigned storage zone
- Warning indicator for urgent expiry

Upon review, the supervisor determines that the alert is inaccurate, likely caused by a manual data entry error or system misclassification.

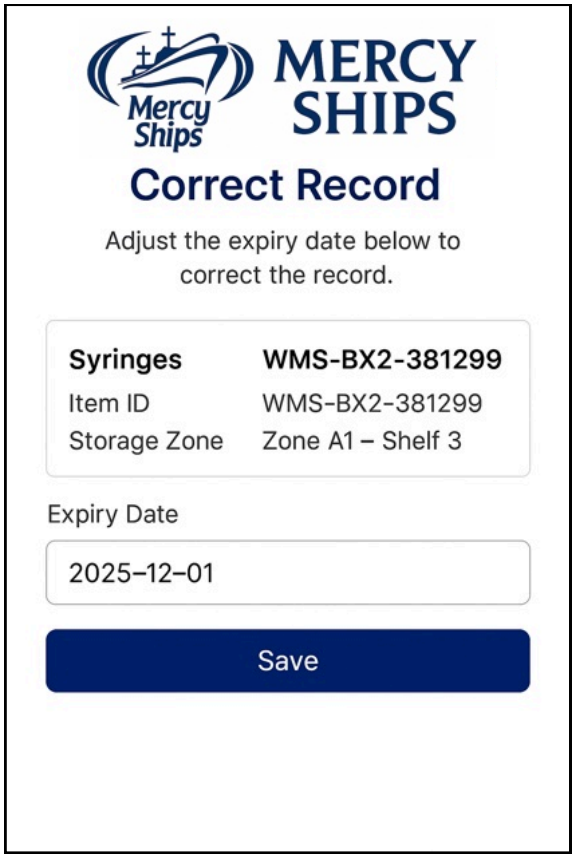
Since the expiry does not actually fall within the 6-month threshold, the user should select “Dismiss Alert” and proceed to update the item’s record on the next screen.



UI Screen 5.1: Correct Record – Expiry Date Update Form

This screen allows a warehouse supervisor to correct an inaccurate expiry date after dismissing a false expiry alert. It displays essential item details such as product name, internal ID, and storage location to ensure the update is applied accurately.

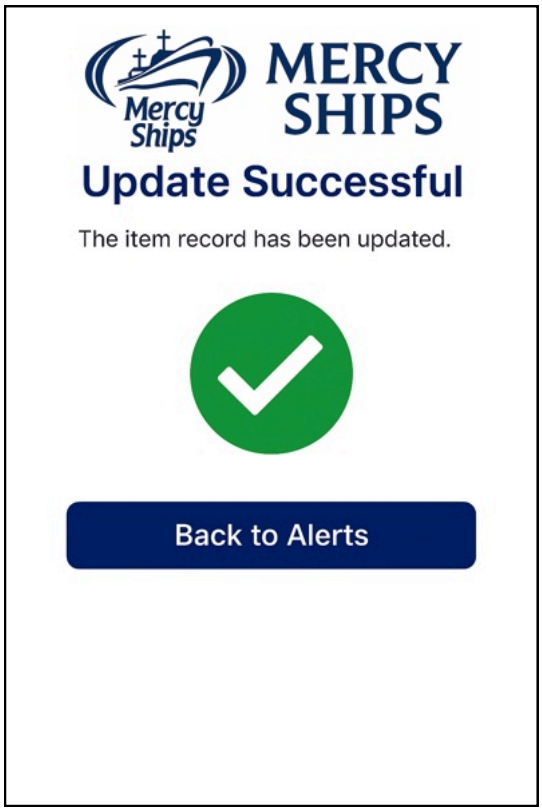
In this example, item WMSBX2381299 (Syringes) was mistakenly flagged to expire in September 2025. Upon review, the correct expiry date is confirmed as December 1, 2025, and the supervisor enters it into the editable field. The interface keeps item information visible and noneditable while focusing user attention on the expiry field. Selecting Save updates the record and removes the incorrect alert from the system.



UI Screen 5.2: Update Successful – Record Saved Confirmation

This screen confirms that the expiry record for item WMSBX2381299 has been successfully updated following the dismissal of a false alert. The corrected expiry date is now stored in the system, and the item is no longer flagged.

The confirmation provides visual reassurance with a large success icon, signaling that the update is complete. The Back to Alerts button returns the user to the alert category they were previously reviewing (Unreviewed Alerts page), allowing them to continue managing other items without interruption.

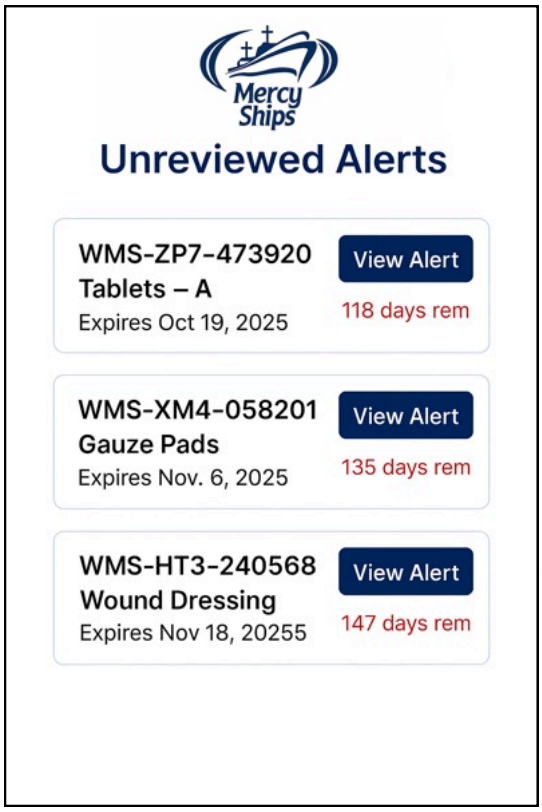


UI Screen 5.3: Refreshed Expiry Alerts List (Unreviewed)

This screen displays the updated list of unreviewed expiry alerts after a previously flagged item has been resolved. The item WMSBX2381299 (Syringes), which was identified as a false alert and corrected, has now been removed from the list.

The remaining alerts are automatically sorted by urgency, with the soonest expiry dates shown at the top. This ensures supervisors are always working with the most current data and can continue reviewing alerts efficiently without interruption.

The refreshed interface reinforces system responsiveness and helps maintain a smooth, continuous validation workflow.



UI Screen 6: Dismissed Alerts Corrected Records Overview

This screen displays a list of expiry alerts that were flagged by the system but later dismissed and corrected by a supervisor. These items are no longer considered active alerts and are retained here for transparency and audit trail purposes.

Unlike the refreshed Unreviewed Alerts list, this screen is accessed directly from the Dismissed category on the Expiry Alert Categories page (UI Screen 3). It serves as a reference for previously reviewed and resolved alerts.

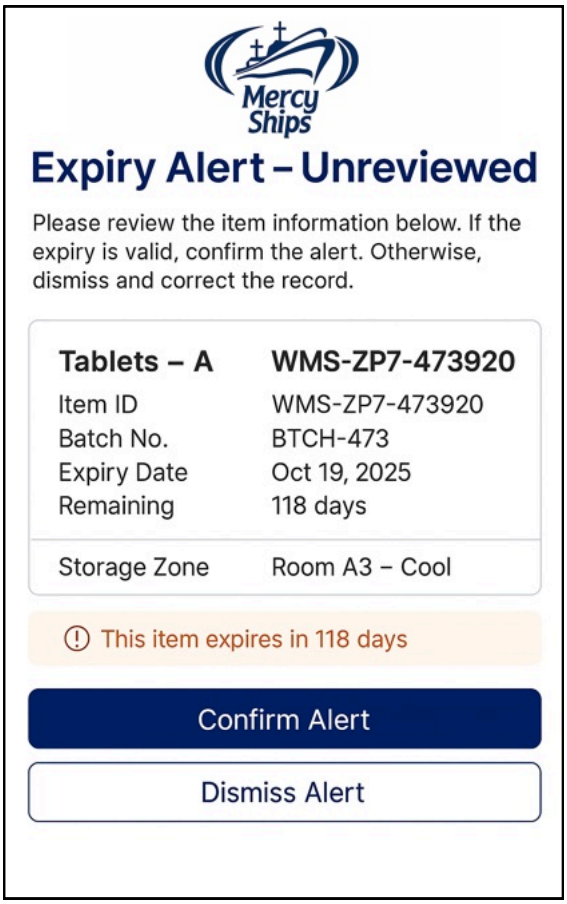
In this example, item WMSBX2381299 (Syringes) is shown with an updated expiry date of December 1, 2025, confirming that the record was corrected and is no longer part of the alert queue. The View Record button allows users to review the correction if needed.

UI Screen 7: Expiry Alert – Unreviewed (Valid Alert Pending Confirmation)

This screen presents the detailed expiry alert for item WMSZP7473920 (Tablets – A), which has been flagged with 118 days remaining. The alert is still unreviewed and requires supervisor action.

Accessed from the Refreshed Unreviewed Alerts list (UI Screen 4), the screen allows the supervisor to assess the expiry details and either:

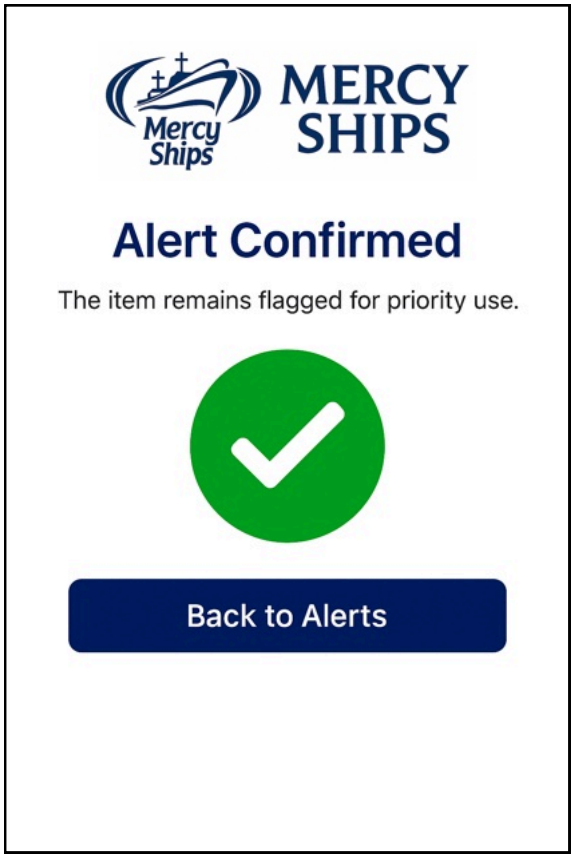
- Confirm the alert to retain the priority handling flag, or
- Dismiss the alert if the data is inaccurate.



UI Screen 7.1: Alert Confirmed – Priority Flag Maintained

This screen confirms that the expiry alert for item WMSZP7473920 (Tablets – A) has been reviewed and validated. Since the item's expiry falls within the 6-month threshold, it remains flagged for priority use or reassignment.

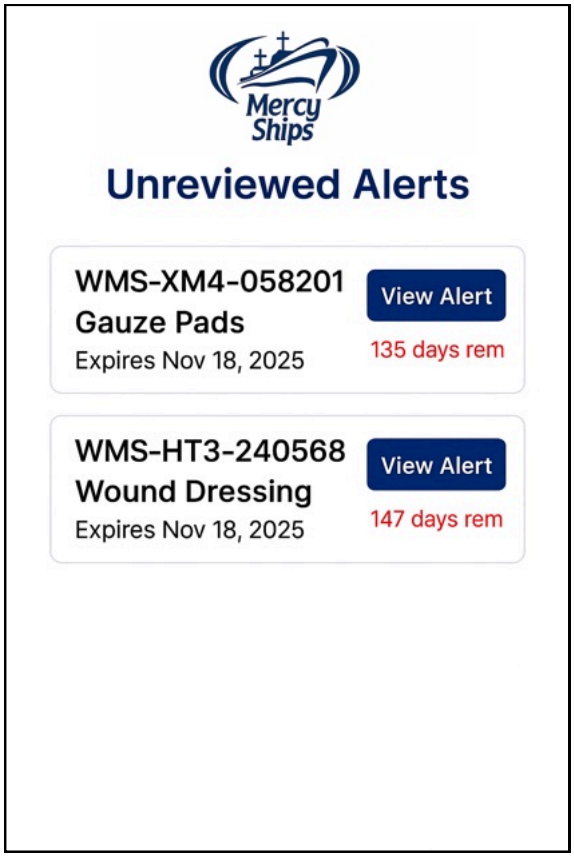
A large confirmation icon provides visual closure, reinforcing that the task is complete. The Back to Alerts button returns the supervisor to the same alert category, ensuring continuity and allowing them to proceed with reviewing remaining items efficiently.



UI Screen 7.2: Refreshed Unreviewed Alerts List (Post-Confirmation)

This screen shows the updated list of unreviewed expiry alerts after a previously flagged item (WMSZP7473920) has been successfully confirmed. That item has now been removed from the list.

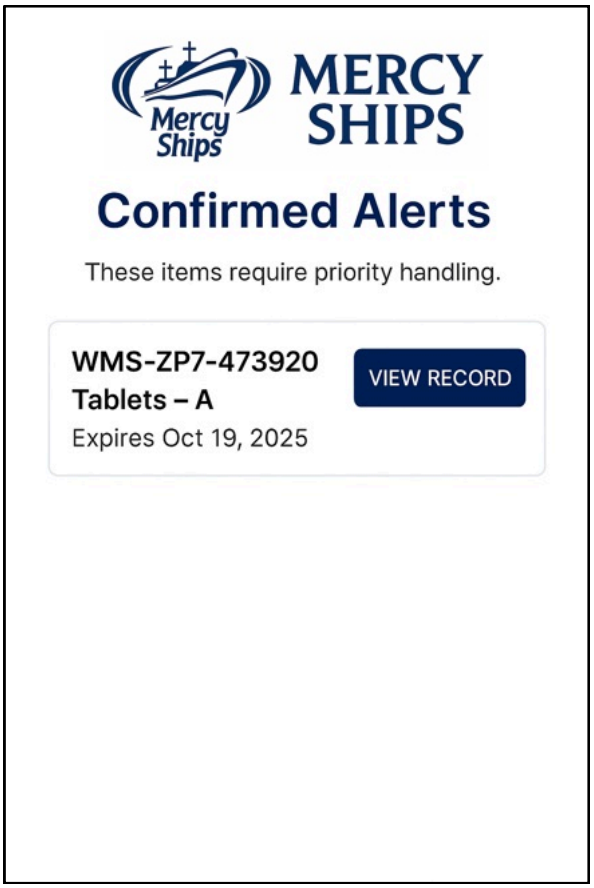
- The two remaining items still require supervisor action.
- Alerts remain sorted by urgency, with the nearest expiry dates listed first.



UI Screen 8: Confirmed Alerts – Priority Items

This screen displays the updated list of confirmed expiry alerts, reflecting items that have been reviewed and validated by a supervisor. In this case, WMSZP7473920 (Tablets A) has been confirmed and is marked for priority handling.

The screen is accessed from the Confirmed category on the expiry alert dashboard (UI Screen 3) and is visible to both supervisors and warehouse workers. This ensures frontline staff are aware of which items require urgent attention.



8.0 APPROACH AND TIMELINE

8.1 Minimal Viable Product (MVP)

The main objective of the Minimal Viable System (MVS) is to demonstrate core functionality while ensuring practical, real-world usability for warehouse staff. For the SkyFlow system, this includes the following key elements:

Feature	Explanation
Manual QR Code Generation	Warehouse staff can create and print QR codes that embed key information about each inventory item. These QR codes are then affixed to the goods, enabling fast digital lookup. This not only replaces manual labeling but also supports efficient tracking, inventory movement and downstream logistics such as transportation and distribution.
Core Data Entry Fields	Warehouse staff manually input essential product details, including item type, expiration date, short description and batch number. This ensures that each item is accurately recorded in the database, forming the basis for effective inventory monitoring and expiry management.
Cloud-Based Central Database	All entered inventory data is securely stored in a cloud-based database. This setup enables centralized access for authorized personnel, supporting real-time data retrieval, backup reliability and seamless collaboration across different teams or locations.
QR Code Scanning Functionality	Staff can use mobile devices or scanners to read QR codes attached to inventory items. Scanning provides instant access to each item's digital record, allowing users to review or update details such as condition, location or expiry status. This reduces manual searching and supports efficient, real-time data management.
Role-Based Access	Users are granted different levels of access (e.g., warehouse staff vs. supervisors). This prevents unauthorized edits and ensures accountability, while also creating a controlled environment for testing user interactions during this early phase.

Table 2: Core features in the MVP stage

8.2 Interim Stage

The interim stage builds upon the initial MVP by introducing more robust features.

Feature	Explanation
Barcode Integration	Integrating manufacturing barcode scanning will reduce manual input errors and increase operational speed with automatic data input. For Mercy Ships, time and accuracy are vital due to the mobile nature of medical missions, this ensures that limited staff can handle large volumes of inventory more efficiently. Barcode systems improve data capture accuracy significantly which is crucial especially when tracking life-saving supplies across ports (Label Warehouse, 2023)
Mandatory Field Validation	Digital entry forms ensure required fields such as expiry date/product category are filled while automatically flagging any incomplete entries or inaccurate entries, reducing data quality issues (Echeverria, 2024). This ensures that essential fields such as product shelf-life and safety are never omitted. For Mercy Ships, such data integrity and information is vital.
Pending Zone & Alerts	The system introduces a checkpoint called the Pending Zone, designed to catch inventory issues early. If an item is missing important details — like an expiry date — it's flagged both digitally and in storage. Supervisors are alerted straight away, allowing quick resolution. (b1cloud@admin.com, 2024). This extra step is especially valuable for Mercy Ships, where accuracy in medical supplies is critical.
Real-Time Dashboard	A simple real-time dashboard will be introduced to help supervisors quickly spot inventory issues. It will display flagged stock, pending entries, and items close to expiry. This helps prioritize actions and speeds up decisions, easing supply chain pressure. (b1cloud@admin.com, 2024). Such dashboards can improve responsiveness in healthcare logistics; essential for Mercy Ships, where avoiding delays and ensuring medical readiness across locations is critical.
Scaled Deployment	Once the first version is tested and refined, the system will be expanded step by step to cover all areas of the warehouse. Rolling it out gradually helps staff get used to the new process without interrupting daily work. Feedback from the initial phase will help improve the system. For Mercy Ships, this careful rollout ensures consistent inventory tracking and makes it easier to manage supplies in every location.

Table 3: Core features in the Interim stage

8.3 Final Stage

The final stage is a robust and intuitive system that will accommodate the full scalability of future projects and donations at Mercy Ships.

Feature	Explanation
Full System Integration	Real-time syncing with Mercy Ship's enterprise resource planning (ERP) will allow for automatic updates on product expiry dates across all inventory locations for e.g. deployment to countries. Deloitte (2022), shows that integration will improve data accuracy and enable proactive expiry management. This is particularly relevant for Mercy Ships, products as medical supplies are often high-value, temperature sensitive and life-critical.
Advanced RFID Deployment	Eventual integration of RFID tagging will enable bulk scanning of items with embedded expiration data, supporting the continuous need for tracking expiration dates. Kshetri (2018) found that RFID systems cut expiry-related inventory losses up to 30%. For Mercy Ships, a phased RFID rollout focusing on critical items complements the cost-effective QR code system used for lower-risk products. This hybrid approach enhances expiry management while balancing cost and operational efficiency, with both technologies integrated into a unified backend for consistent tracking.
Automated Alerts and Predictive Analysis	Automated expiration dates trigger timely removal or prioritisation of near-expiry data. Predictive analytics forecast inventory demand to avoid overstocking and expiration. Wamba et al, (2020), reports such tools reduce expired stock by 25-40% optimizing supply chain sustainability as operations grow.
Comprehensive Audit and Compliance Reporting	Automated audit trails document expiry tracking compliance with healthcare standards and donor requirements. Transparency International (2022) highlights that detailed compliance reporting reduces risks of expired or unsafe medicines reaching patients, essential for Mercy Ships' safety reputation during expansion.
Enterprise-Scale Deployment	Deployment across Mercy Ships' growing global supply chain ensures standardized expiry tracking and inventory management practices. Gartner (2023) emphasizes that scalable systems maintain data consistency and enable centralized oversight, critical for managing expiry-sensitive medical supplies at scale.

Table 4: Features in the Final Stage

8.4 Timeline

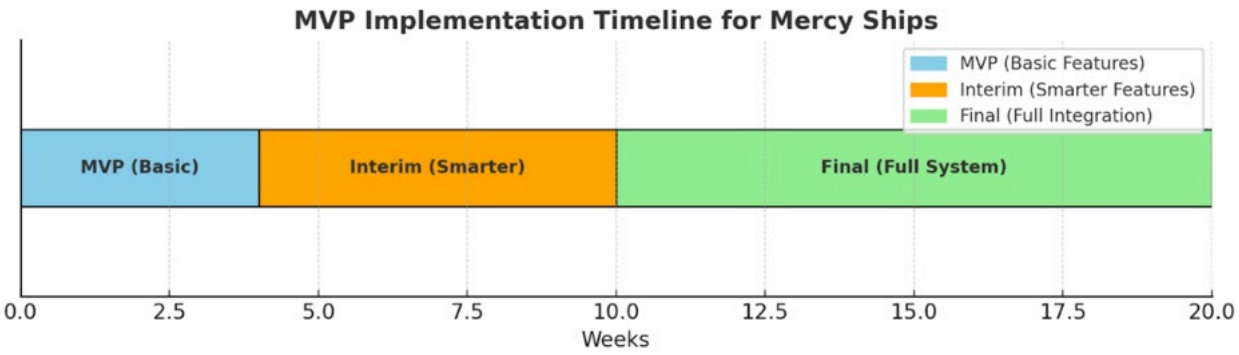


Diagram 7: MVP Implementation TImeline for SkyFlow

The visual timeline illustrates the development and implementation of the SkyFlow expiry tracking system for Mercy Ships over a 20-week period. It is divided into three progressive stages which are MVP, Interim, and Final, each designed to build on the previous phase with increasing functionality, complexity, and scalability.

8.5 Feedback Loop

It it necessary to identify key pieces of feedback to gather from users to better shape the next iteration of SkyFlow. The goal is to validate that the system is practical and usable in real-world warehouse conditions while gaining insights that inform future advancement. As such, a few feedback loops have been identified, see:

From MVP to Interim Phase :

What we need to learn	Why it matters
How do warehouse workers use QR codes in their daily workflows?	To will enhance integration with other features like scanning, expiry alerts, and digital updates.
Which data fields are mostly used?	To priortise field validation and improve input efficiency.
How often are staff scanning items to check or update expiry records.	To streamline the lookup process and optimise scanning interactions for expiry tracking.
Is the current cloud sync system smooth for users when managing expiry data?	To prepare for more advanced expiry features like dashboards and real-time alerts
Are user roles working as intended - regarding access?	To support clearer workflows and build accountability features.

Table 5: Feedback in the MVP to Interim Phase

From Interim to Final Phase:

What we need to learn	Why it matters
What particular situations do staff prefer scanning over other expiry lookup methods	To enhance bulk workflows and determine where automation can support high-volume tasks.
How effective are expiry alerts and pending item notifications in keeping things on track?	To refine alert prioritization and automated flagging rules for upcoming or overdue items.
Which parts of the expiry dashboard are most helpful for timely decision-making?	To build smarter dashboards that guide real-time actions around expiry inventory.
How consistent is expiry-related system usage across different teams or departments?	To ensure scalable design and prepare for system-wide rollout for traceability across multiple stakeholders.
How do users feel about the current responsiveness and ease of navigation?	To enhance usability as we add more complex integrations in the Final Stage.

Table 6: Feedback in from Interim to Final Phase

Summary : Each development phase was shaped by direct user feedback. The final system is being built not just to fix pain points, but to scale with Mercy Ships' expanding operations, ensuring it works seamlessly in real-world conditions now and into the future.

9.0 TEAM AND PROJECT PLAN

9.1 Communication and Collaboration Tools

A range of multi-collaborative platforms was implemented to ensure accessibility and transparency with all team members (refer to table 2).

Platform	Agenda
WhatsApp Group Chat	Used for updates, reminders, informal communication and general coordination.
Google Drive	Centralised document repository. Containing: • Meeting agendas and notes • Working drafts and research material • Final submission and references
Zoom (recurring link)	Used when-in person meetings aren't viable. See following for link: https://uni-sydney.zoom.us/j/86528515465
Google Calendar	Shared calendar with the scheduled meetings, internal deadlines and Zoom links.

Table 7: Overview of the communication and collaboration platforms used.

9.2 Meeting Schedule

As determined by each member's personal schedules, 2 weekly meetings had been organised (refer to table 3). If team members required adjustments, they were to report within the WhatsApp group chat so that accommodations could be made.

Days	Agenda
Fridays at 2:00pm	Face to Face meetings in the PNR buildings after the workshop. Primarily to discuss weekly submissions and feedback.
Tuesdays at 4:00pm	Zoom meetings for check-ins, problem-solving, and progress updates.

Table 8: Online and in-person meeting schedule between week 3-13.

9.3 Project Submission Allocations

Phase	Task Allocation
Phase 1: Discussion about upcoming WS and reviewing previous submissions.	*At the meeting at the end of each workshop, we:* • Had a rotating meeting facilitator that led discussion. • Reviewed the next WS brief. • Identified key deliverables and divided the WS into tasks. • Realistic deadlines were discussed to prevent conflict/delays. Typically, the contributions were to be completed prior to the mid-week meeting (phase 2). • Previous submissions were also discussed, and feedback was adapted to create a revised version.
Phase 2: Discussion	*During the mid-week meeting, we:* • Reviewed contributions to ensure cohesiveness and quality of the work. • Flagged concerns, discussed adjustments and made changes. • Ongoing discussion about previous versions. • Reviewers were selected for the next phase.
Phase 2.5: Redistribution of tasks	*If personal schedules were changed throughout the week, or deadlines could not be met:* • The affected member updated the team via the WhatApp group chat. • The team redistributes the task to ensure that deadline was met; this was typically discussed in the group chat. • This phase helped to ensure transparency and shared responsibility.
Phase 3: Final Review and Submission	*Reviewers were expected to:* • Ensure work had clarify and coherence • Ensure proper referencing and formatting • Academic Integrity

Table 9: Phases between each workshop to ensure completion of WS task.

This approach to assigning roles and responsibilities each week was flexible to meet team's changing responsibilities. This process unfolded between each workshop and included 3 phases to ensure the WS was completed (refer to table 4).

9.4 Risk Management

Risk	Management and Action Plan (if detected)
Team member leaving the group	We have fostered a supportive team culture that encourages early communication of personal or academic challenges. By doing regular check-ins during meetings, we aim to identify issues before they escalate. **Action Plan:** 1. Discuss with the team immediately. 2. Reassign Tasks. 3. Adjust project timeline and inform unit coordinator.
Freeloader / Lack of Contribution	All work is completed in a shared folder in google drive, making individual contributions transparent. Weekly monitors also allows us to manage engagement. **Action Plan:** 1. Elect a team member to have a private conversation. 2. Temporarily redistribute tasks so deadlines can be met. 3. Notify the unit coordinator if the issue persists. 4. Document the issue in the case of fairness assessment.
Unequal load distribution	Tasks are assigned based on individual strengths per meetings. Roles are also rotated weekly to prevent unbalanced workloads. **Action Plan:** • Review the individual contributions during meetings. • Adjust task allocation if workload is unfair. • If problem persists, see above section.
Plagarism	Clear expectations have been set regarding academic integrity. A rotating member will oversee proper referencing each week to ensure formats are followed. **Action Plan:** • Elect a member to discuss the issue privately to understand the issue (pressure or confusion). • Require the team member to do re-do the work with proper referencing. • Reinforce team understanding.

Table 10: Risk management prevention strategies and action plans if risks are detected.

9.5 Team Expectations

To ensure clarity, we have outlined expectations that are specific and measurable:

- Attend all scheduled meetings or notify the group at least 12 hours in advance if unavailable.
- Come prepared, having completed assigned work.
- Communicate regularly and respectfully.
- Accept feedback and provide it constructively.
- Submit individual tasks by internal deadlines (usually 2–3 days before submission).
- Support one another if someone falls behind due to valid reasons.
- Be transparent and honest in all academic work.

9.6 Project Timeline

To ensure clarity and structure throughout the semester, our team has created a Gantt chart that outlines all key project milestones and submission deadlines from Week 1 (team forming) through to the final submission in Week 13 (refer to diagram 7). This visual roadmap helps the team stay aligned with weekly goals, delegate responsibilities, and monitor progress over time. It also provides a shared reference point if any adjustments need to be made due to unforeseen circumstances.

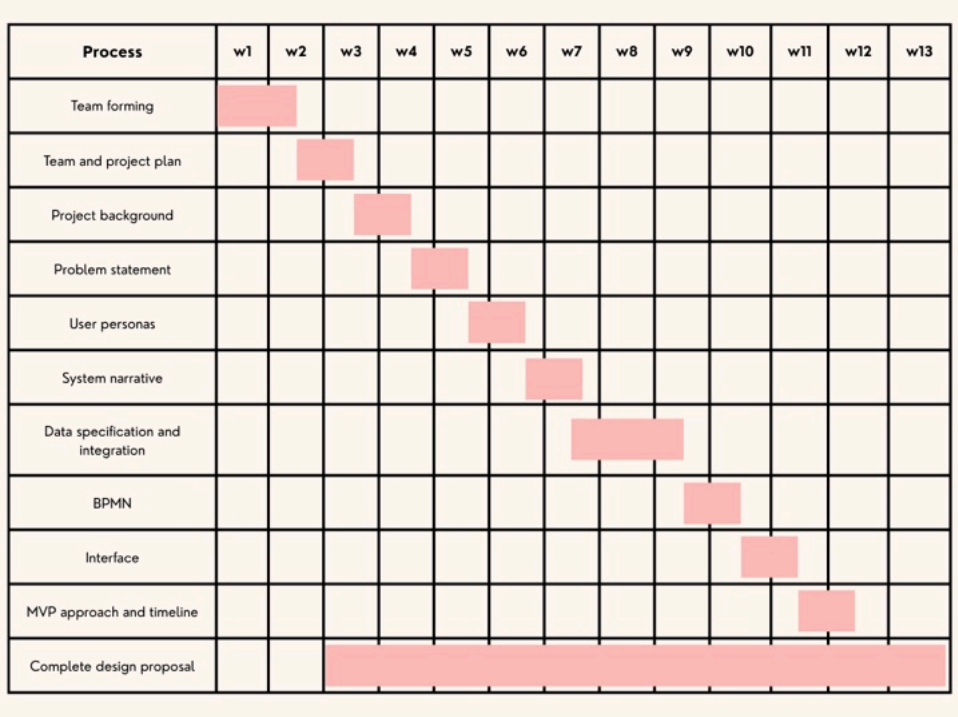


Diagram 8: Gantt Chart of Project Timeline

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