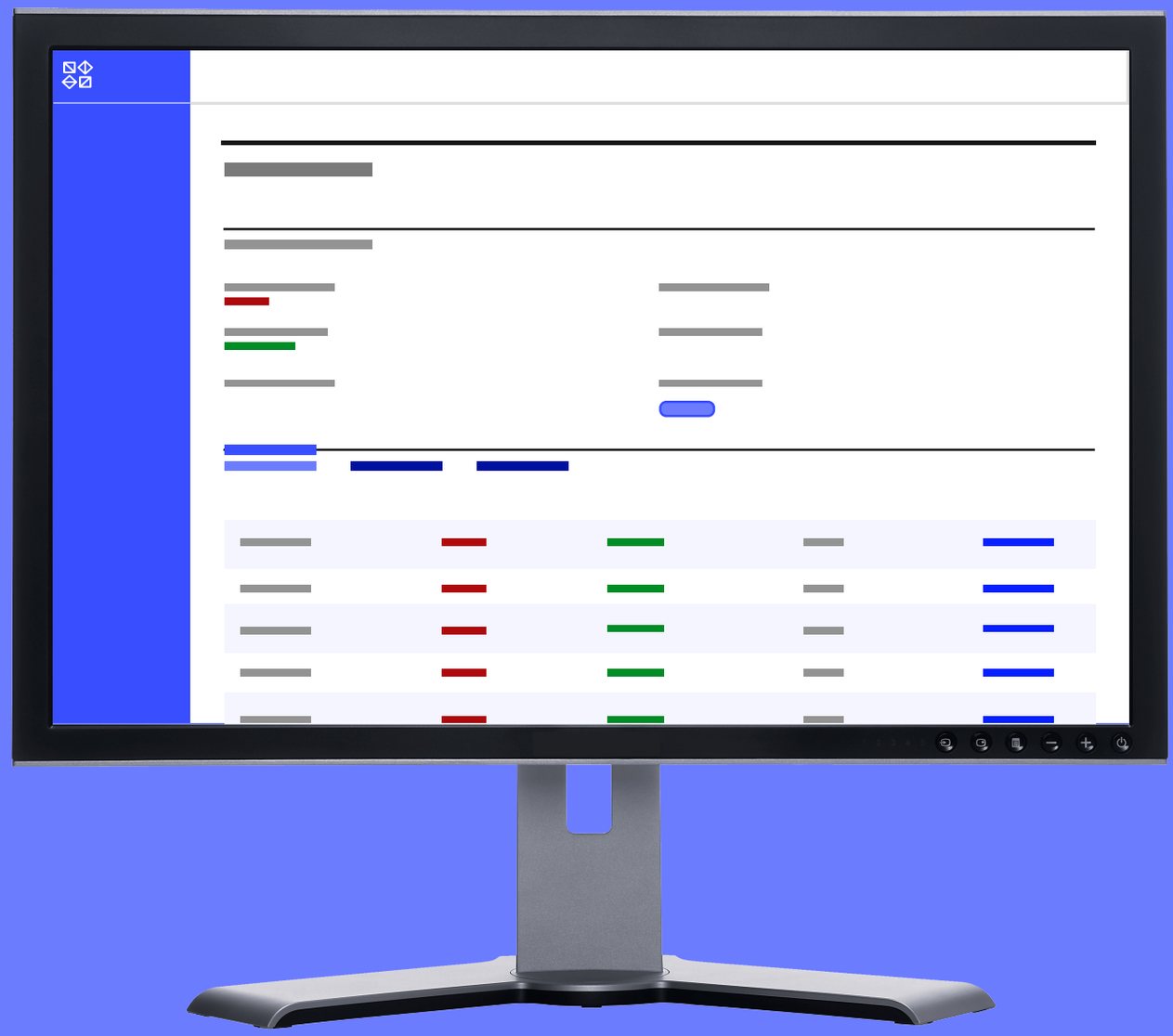
Blackbox

Inventory Management System Redesign

Platform: Web

Role: Principle Designer

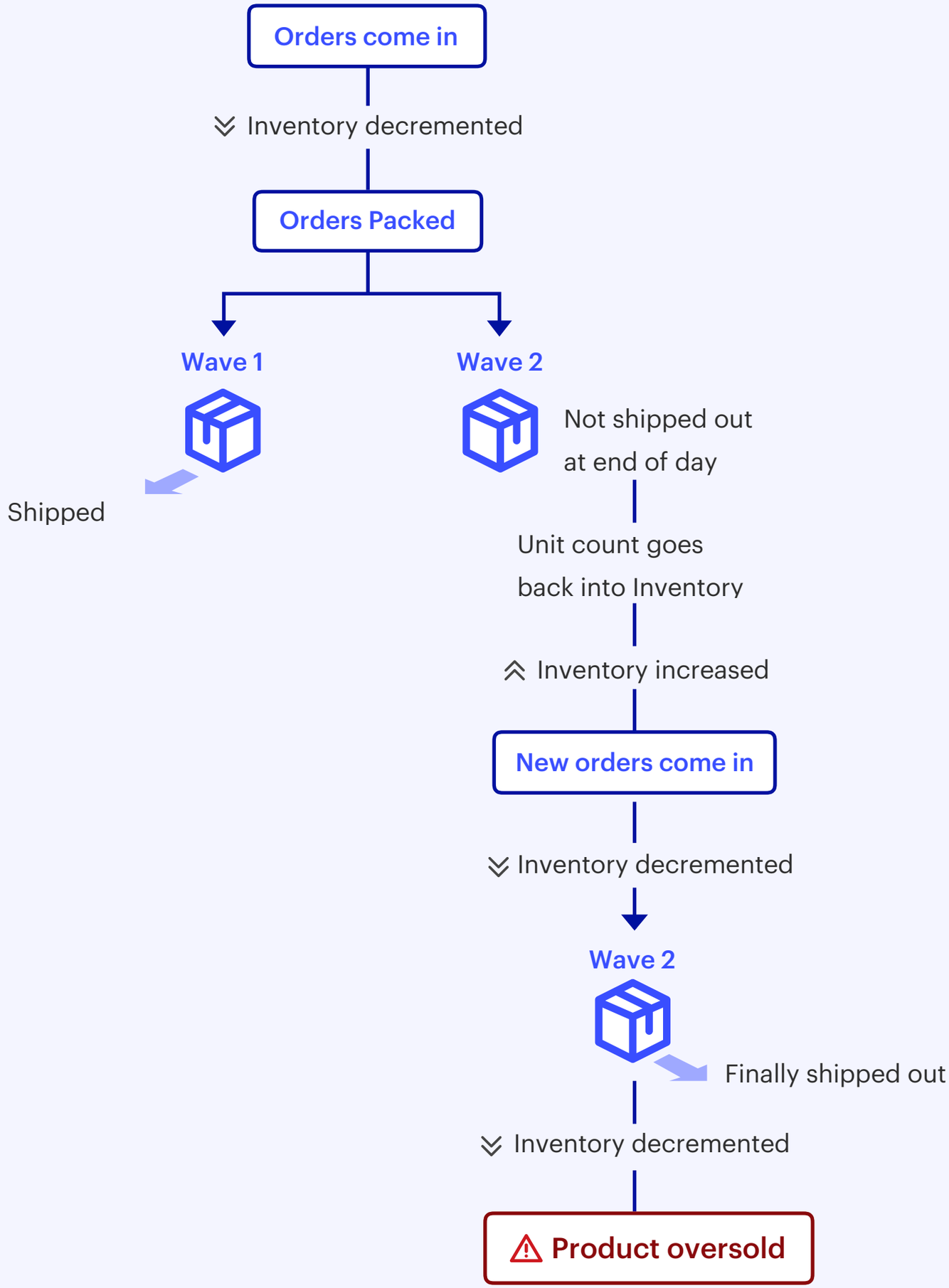
Opportunity: Redesign Blackbox's inventory management system to display accurate data, promote transparency of stock movement and processes, and lighten the manual workload of the internal Logistics team. Create the foundation to transforming the Blackbox system into the source of truth for client inventory.



Context and Existing Issues

The current inventory management system (IMS) is a ledger system that is riddled with pain points. It often displays inaccurate stock count due to timing mishaps with warehouse API calls, entails an immense amount of manual work for the internal Logistics team, and information is buried in rows and rows of tables.

A recent snafu came with the launch of a client's product. The new product over sold resulting in angry customers and client. Orders are shipped out in waves, with inventory count being decremented, and then increased again when packed, but promised inventory was not shipped. The dashboard reported more available inventory than was actually available for purchase.



The Stakeholder: Susie, the Logistics Manager

Stage: Discovery

Method: Shadowing, interviewing

To get a contextual lay of the land, the top priority was getting to know who manages the inventory, and how they do it. I spent a multiple shadow sessions with Susie, the Blackbox Logistics Manager, watching her perform her tedious tasks and enacting her workarounds for the holes in the existing Inventory Management System.

Susie's workflow was painfully manual, involved multiple back and forths with warehouse managers, and entailed a lot of neurotic tracking through homegrown means.

Susie Harvey

Logistics Manager

Bio

Susie came to the team with years of inventory and production experience from large corporations. With her wealth of knowledge, Susie is involved in myriad aspects of the business and can often be found multitasking. All of Susie's activities are on a schedule and she gets frustrated when she is blocked from doing her job. Susie is capable of crafting (sometimes sneaky) workarounds to some issues throughout the shipping and fulfillment process, but is tired of Blackbox/CAH being "cute" about it.

Goals

- Ensure inventory moves seamlessly from start (creation) to end (shipped and sent to customer)
  - The right number of items are shipped
  - Inventory leaves and arrives in good condition
  - Inventory is sent to the right location
  - Inventory arrives at the expected date

Role and Responsibilities

- Keep track of unshipped orders, be in the know regarding stuck or stagnant orders
- Work with Accounts to set up Shipments and head off any issues/discrepancies that may occur
- Book Shipments and communicate with warehouses in a timely fashion
- Act as a liaison with warehouses throughout the shipment process
- Manage inventory of products and shipping materials

Needs

- Alignment with clients, Accounts team, and warehouses re: inventory and expectations
- Set and communicated deadlines, synced expectations vs. actuals
- Up-to-date and accurate information for dates, IDs, and quantities

Routines and Habits

- Start off the week catching up with emails and warehouse activity from the weekend
- To stay organized -
  - Takes a snapshot of the start of her work week to compare movement of inventory and closed out commitments over time
  - Sorts and tags all emails
- To keep parties on the same page -
  - Creates and sends separate emails to warehouse and Accounts re: Shipments
  - Keeps a log of actions, issues, and communication between parties on each Order or Shipment
- To accomplish a task for any particular Order or Shipment -
  - Keeps many tabs open per Order/ Shipment to have simultaneous view into inventory, status, notes, relevant emails, etc.

Frustrations

- Incredibly manual workload
- Only person with expertise and ingrained knowledge in domain
- Unreliable or incomplete data from clients
- Lack of guidelines/compliance agreement with clients; results in a bumpy fulfillment process as team works to accommodate
- Unmatched sense of urgency between Ops and Tech

Relationships

- Accounts
  - Handoffs and data alignment for client Shipments
- Warehouse Coordinators
  - Send and receive notices re: Shipments, dates, quantities, quality check
- Blackbox Product Team
  - Communicate needs for updates/ improvements to increase efficiency and functionality
  - Stay informed on/involved in what's being worked on and changes that impact workflow

Tools Used

- Google Forms to collect product information
- Blackbox Dashboard
- James & James Dashboard

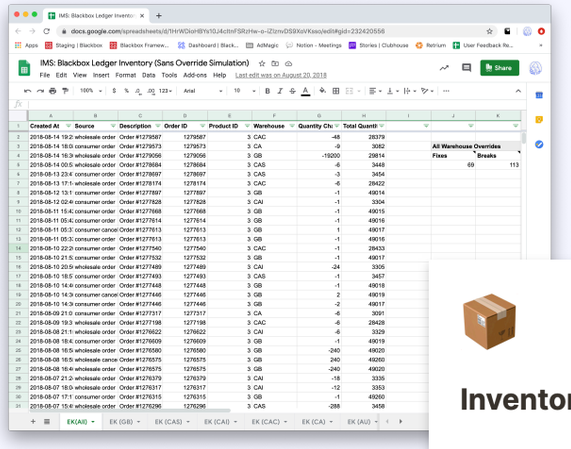
Data Experiment: Understanding the Existing Discrepancies

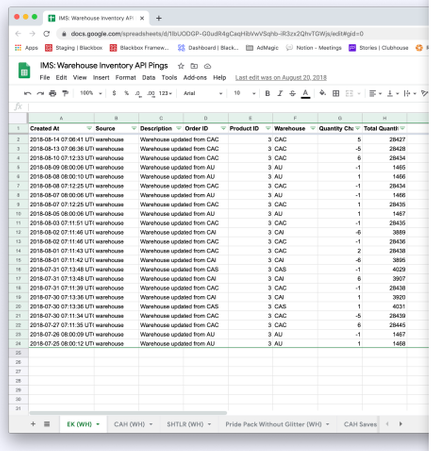
Stage: Discovery

Method: Data comparison test

- Worked with inventory data for 5 high-traffic products
- Simulated separation from warehouse API calls
- Tallied deviations in unit counts between the Blackbox system and warehouse reports

I ran a database simulation to quantify the typical gaps in inventory counts between what our partner warehouses reports and what our existing system was able to track. This showed the team that there were sometimes discrepancies as large as entire casepacks. This would be a significant loss for our independent creator clients.





Inventory: Data Comparison Test

Goal(s):

- Observe real comparisons between Blackbox captured inventory logs and Warehouse APIs' inventory entries and inventory totals with real and live client data
  - See how well data lines up and where/when it might deviate
    Observe the frequency of deviations at various scales and whether or not there is a pattern for self-resolution or need for manual intervention
  - Use findings to inform future of inventory checks and (hopefully) low-lift discrepancy resolution process

Orders:

- Last 2-3 weeks of orders
- Inventory totals with time stamps for chosen products through BBX log and warehouse pings
  - Columns: Product ID - Count (Total units) - Created At - Object Type - Object ID - Description - Status
- Entries?

- Cards Against Humanity -
  - CAH Saves America Pack (product_id=780)
  - Cards Against Humanity (product_id=9)
  - Pride Pack Without Glitter (product_id=778)
- Exploding Kittens -
  - Exploding Kittens Original Edition (product_id=3)
- Goat, Wolf, & Cabbage -
  - Secret Hitler (product_id=66)

Deliveries (need to build delivery approval with discrepancy resolution):

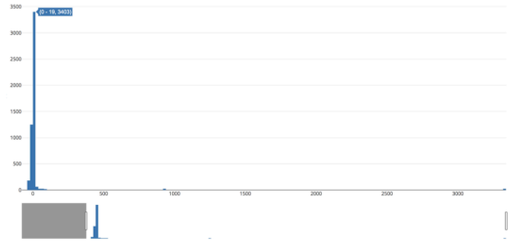
- Last 2 months of deliveries
- Inventory totals with time stamps for chosen products through BBX log and warehouse pings
  - Columns: Product ID - Count (Total units) - Created At - Object Type - Object ID - Description - Status
- Cut.com, Inc -
  - Fear Pong Game (product_id=821)
- Exploding Kittens -
  - Exploding Kittens Party Pack (product_id=378)
- Twogether Studios -
  - Knight of Summer Totebag (product_id=396)

Method

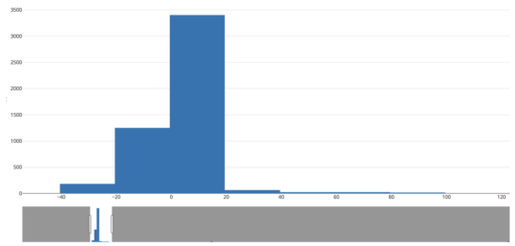
- Jon pulled data for orders from the last 2 weeks for 5 products at all warehouses (linked below)
- Separated orders by warehouse into their own spreadsheets (linked below)
- Pulled out log entries from warehouse API override pings into a separate document (linked below)
- Created a new column for Calculated Quantity to represent standalone Blackbox ledger system without API overrides from warehouses
  - New baseline/starting point created by taking quantity change and total quantity (w/ warehouse API)
  - Used new baseline and quantity changes from orders to calculate subsequent totals (Calculated Quantity)
- Calculated the difference between Total Quantity (with Warehouse override) and Calculated Quantity (w/o checkin overrides); utilized conditional formatting to highlight the range of difference
- Generated histograms per product-warehouse spreadsheet to see range of discrepancies (x axis) against how often a discrepancy of that size occurred (y axis)
- Utilized first 5000 lines of Calculated Difference (plot.ly line limitation) to generate overall range and number of occurrences (histograms shared above in results)

Results Summary

- More often than not (113 incidents to 69) the warehouse pings created a larger discrepancy (moved the difference further from 0) than fixed it (moved the difference closer to 0)
- The largest difference between the two logged quantities was 3,323 units of Secret Hitler at Geodis Sparks, followed by a difference of 925/923 Secret Hitler units at Geodis Sparks, and 84 units of Cards Against Humanity at Geodis Chambersburg
  - Most differences were under 100 units (with varying total product inventory), with the bulk of occurrences showing discrepancies in the -20 to 20 units range
- This only counts orders and does not include data from inbound shipments and transfers, which have a big impact on inventory
  - System would not work without inbound and transfer integration, otherwise the difference between sources will never resolve on its own



Histogram 1.1: The range of differences between quantity logged with warehouse override and quantity logged sans warehouse override (x) against the number of occurrences (y)



Susie's Reactions

- Surprised by the SHTLR discrepancy, but could pinpoint what the cause was (pulling stock for Gen Con) and knew next steps (follow up with Maya)
- Still think 40 units (absolute value of majority discrepancy range) was still a lot
  - "That's more than a case pack of most of the things we carry... That might be okay for Cards, but most of our clients are not like Cards and we would not want our clients to see that."
- 20 unit discrepancy is still pretty high and matters for our smaller clients
- Trust warehouse inventory numbers more than Blackbox... should be default for inventory
  - The only ones who see both sides of the picture
- Context share:
  - Just tracking the order portal = garbage
    - It cannot handle wholesale or inbound shipments but it's what we've got right now
    - Not the behavior we want to rely on for tracking
  - Orders can't be placed off inventory
  - Inventory gets shipped to receiver
    - Paper work filled out (cost to file); take cost of goods + amortized (lump sum _ add a bit of cost for each unit) >> Carded cost
      - Do all the steps necessary to get the goods to final location and set retail price when it gets there
      - Calculate retail margin % and store in system; average cost and decrementing units... *then* warehousing software interacts with inventory software
      - Warehouse + ordering system is one thing
  - Listen to warehouse statuses, not their numbers
  - Orders should go against BBX ledger
  - Would be comfortable with a percentage-based threshold for notification PLUS a strict numbers threshold (looking back at 40 units being too large a discrepancy, regardless of comparison to total stock)

Competitive Analysis: What Makes Other IMS's Work?

Stage: Discovery

Method: Product exploration, online research

I signed up for demos of a few B2C inventory management software to compare offerings and functionality. I paid attention to how these tools manage products, data, and inventory movement.

The top findings were that automation, transparency of unit counts through stages of shipment, and alerts to discrepancies or issues were common threads throughout.

How might we center the redesign around these ideas to make life easier for our team?

Inventory: Competitor Research

Overview

While there are key differences in the Blackbox model of inventory management from the wider market, there are still things to learn from existing and established inventory management tools and systems.

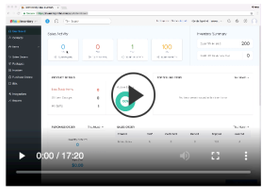
Common Characteristics and Offerings

- Automation - stock is synced across all channels (sales, warehouses, etc.) automatically
  - *BBX currently has backend logging (?), but is still manually entered by Susie and team in-app*
- Tracking of stock through all stages of transit and shifts (orders, deliveries)
  - *Not being able to automatically and accurately track stock and movement makes it impossible and unwieldy to manage the current workload as well as scale up the business*
- System to keep stock at the right level (calculations to avoid drastic overages or running too low on stock based on order patterns) >> alerting
  - *Can't fulfill orders at all or in a timely manner if we're out of products that customers want to buy in any or the appropriate location*
- Configurable reporting
  - *If don't know the status of stock, can't properly or smoothly do transfers or fulfill orders*

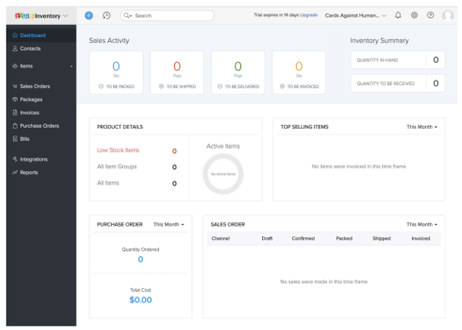
Zoho Inventory

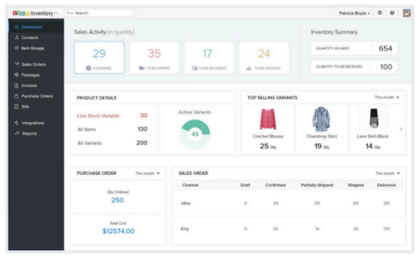
Description from site:

Inventory management software for growing businesses. Increase your sales and keep track of every unit with our powerful stock management, order fulfillment, and inventory control software.

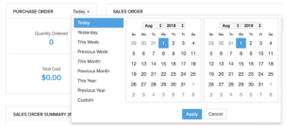


Dashboard

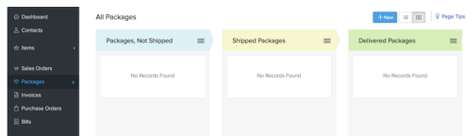




- Live reporting of activity across the stages of shipping and payment
- Quick snapshot of inventory - how much is in stock and how much is expected to be added
  - Is it just a sum of all products for client or can it be broken down?
- Front page alert for items that are low in stock
  - Might not actually link out to items that need attention
- Can see movement and of product from channels and filter by custom date range

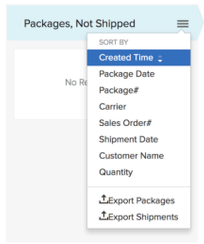


Packages (Status Tracking)



- Tracks packages as a story board based on shipping status from ordered and unshipped to delivery completion

All Packages



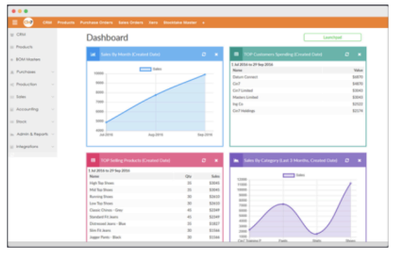
From a 5 star review: *Very complete! I like the overall feel and UI for this software. I like how it was thought about and implemented. I like that it offers many integrations and generally can do nearly everything I need it to do. I like how it is like lego's, I can select one module and then when ready set up another Zoho module and they will work together. Over all I like the product.*

Cin7

Description from site: Cin7 is the automated inventory management platform for brands growing their revenue over $1 million. Cin7 synchronizes their stock with sales and orders across every physical and online sales channel and automates order processes for greater efficiency. Cin7 is not ideal for Rentals or Asset management type of businesses. Brands that sell or distribute products use Cin7 to keep costs down, margins and cash flow high and stock at the right level.

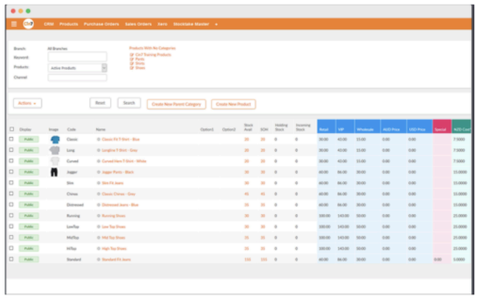
Note: Can't get access to a free trial without talking to a representative, so using screenshots provided by Capterra (business software evaluation service)

Dashboard



- Real-time reporting of stock over time and by category

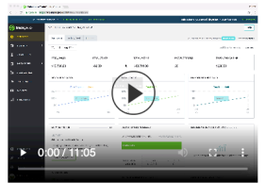
Product List



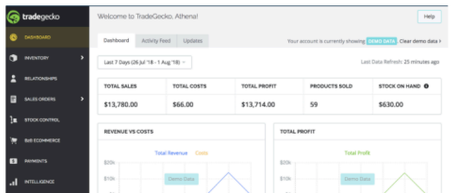
- Detailed list of information tied to each product, easy to see the stock available and incoming stock... doesn't say stock at location or what incoming means, per se

TradeGecko

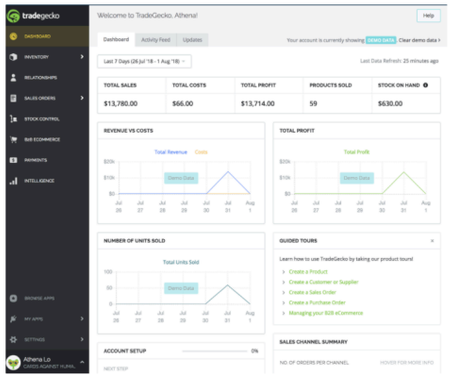
Description from site: TradeGecko is an inventory management platform, built for multichannel brands, specially high growth eCommerce and wholesalers. It enables automation for omnichannel operations, improving efficiency and increasing profitability.

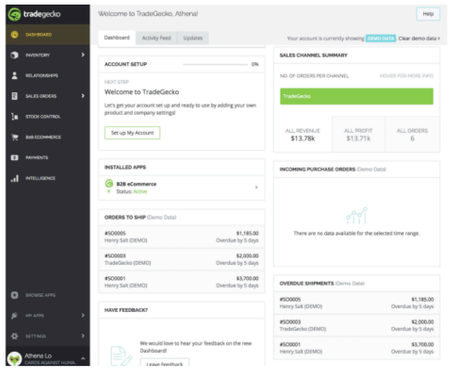


Dashboard



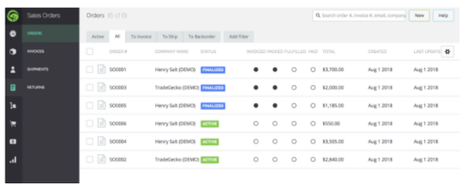
Dashboard





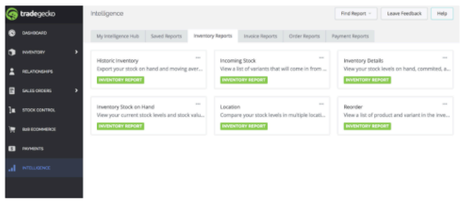
- Bucketing between dashboard for snapshot, activity feed for running updates on internal actions, and software updates
- Date filter that impacts entire dash
- Bucketing between dashboard for snapshot, activity feed for running updates on internal actions, and software updates
- Date filter that impacts entire dash
- Ribbon of top level metrics
- Modules that link out to detailed information in the software
- Tracking relevant metrics over time
- Compare information re: sales between channels
- Incoming purchase orders elevated to front page
- Alert to upcoming and overdue shipments

Orders

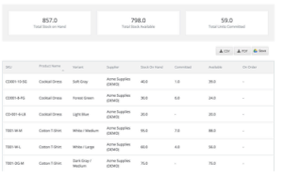


- Clear status tracking through order fulfillment process
- Dates for creation and last updated (transparency re: updates and action on orders)
- List

Intelligence



- Customizable reports can be created
- List of ways to cut inventory data for reporting (historic, on hand, by location, incoming, etc.)



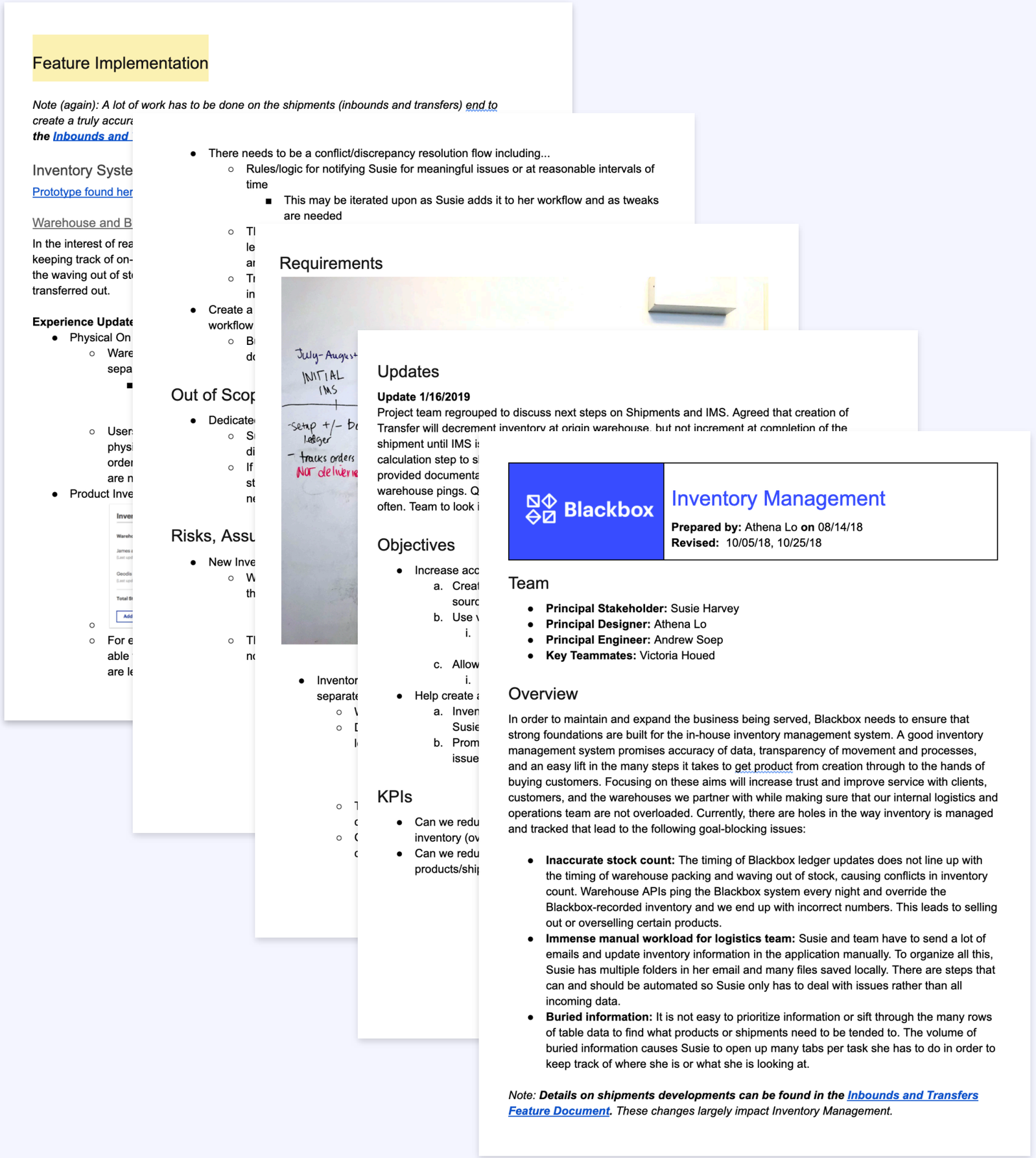
Feature Document: Maintaining a Central Source of Truth

Stage: Ongoing documentation

To make sure the small team stayed aligned throughout the process, I put together a structured feature document. The focus was on ensuring the central goals were agreed upon, noting what risks to watch out for, and making sure the scope was clear.

As a living document, it was updated as changes were made. This included details for the functional spec, tech implementation, and any new team decisions.

Throughout design and development, communication and transparency were key with stakeholders and all teammates.



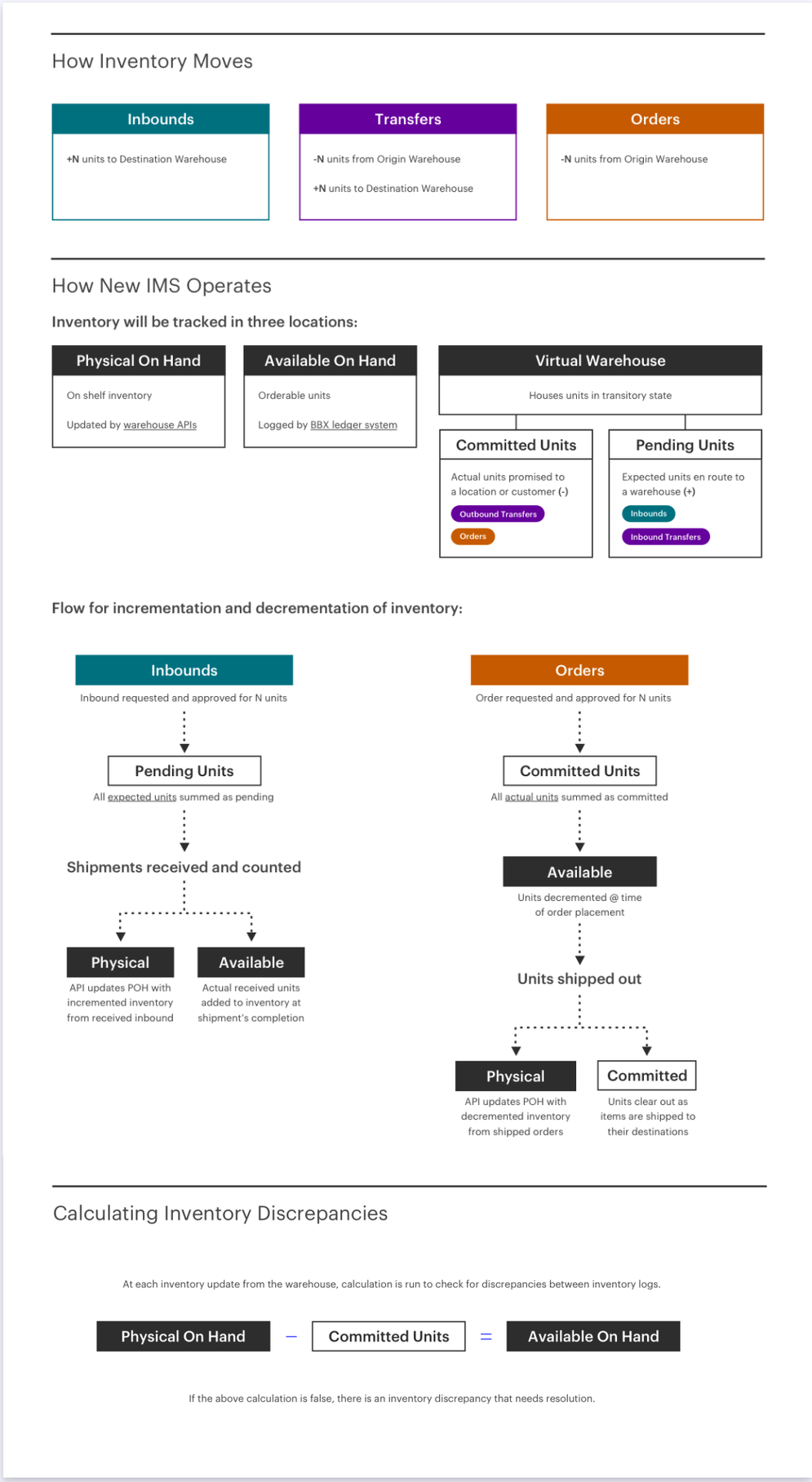
Communicating the New System of Inventory Tracking and Calculations

Stage: Ideation

For there to be clarity in the movement of units throughout their product lifecycle, new distinctions had to be added to how inventory was tracked.

With the addition of following pending, committed, physical on hand, and available on hand units, there will be a lot more awareness around the actual quantity, status, and location of product.

We should also be able to clearly calculate when there are unexpected discrepancies for a true count of available units.

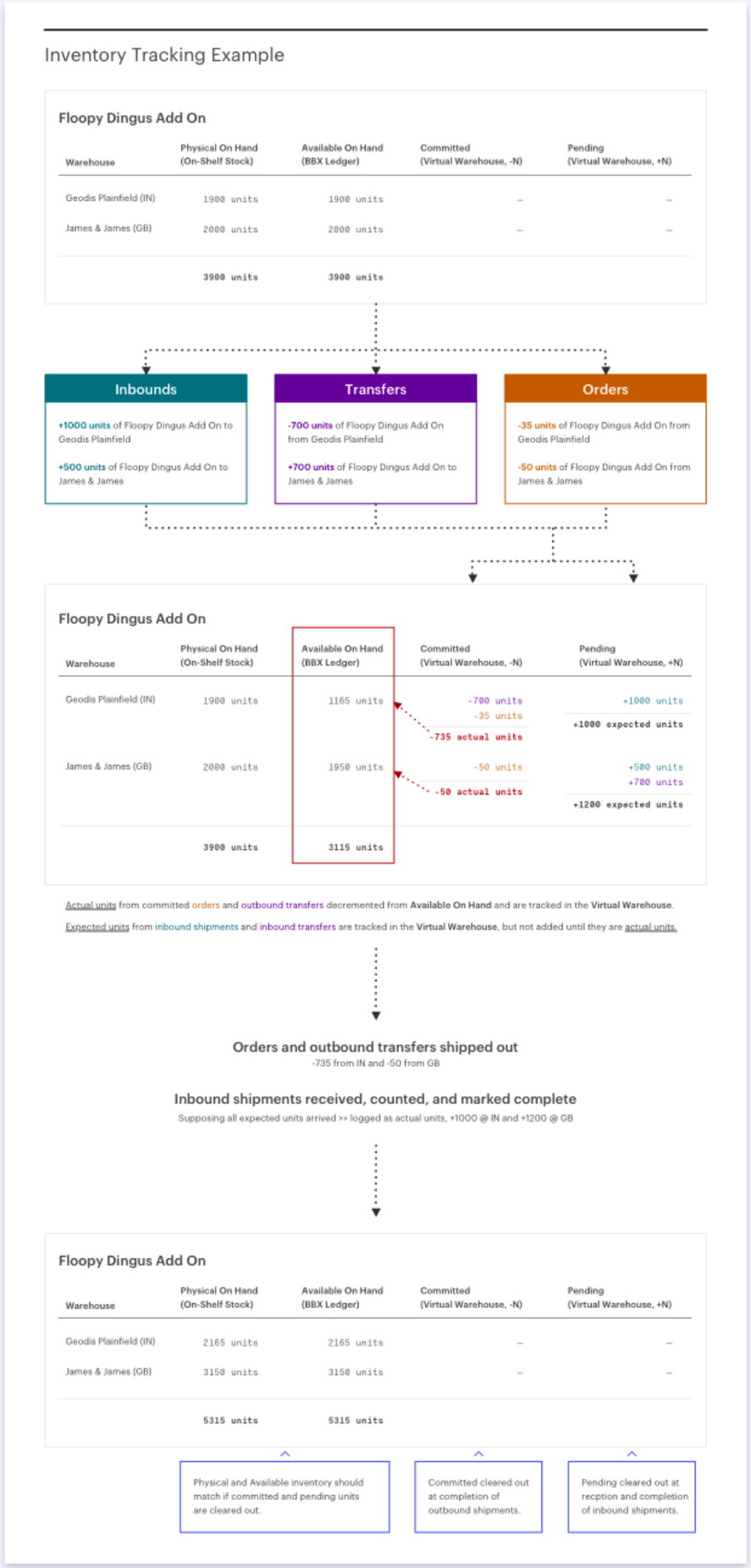


Inventory Movement Demonstration: Does It All Add Up?

Stage: Ideation

To demonstrate how the aforementioned additional inventory distinctions would ensure that the Blackbox IMS would be reporting true unit counts, I put together a visual to communicate how inventory calculations would work.

This flow helped align the team in understanding the importance of transparency, and the impact of clarifying the movement of inventory (intended vs. actual) when reporting available units.



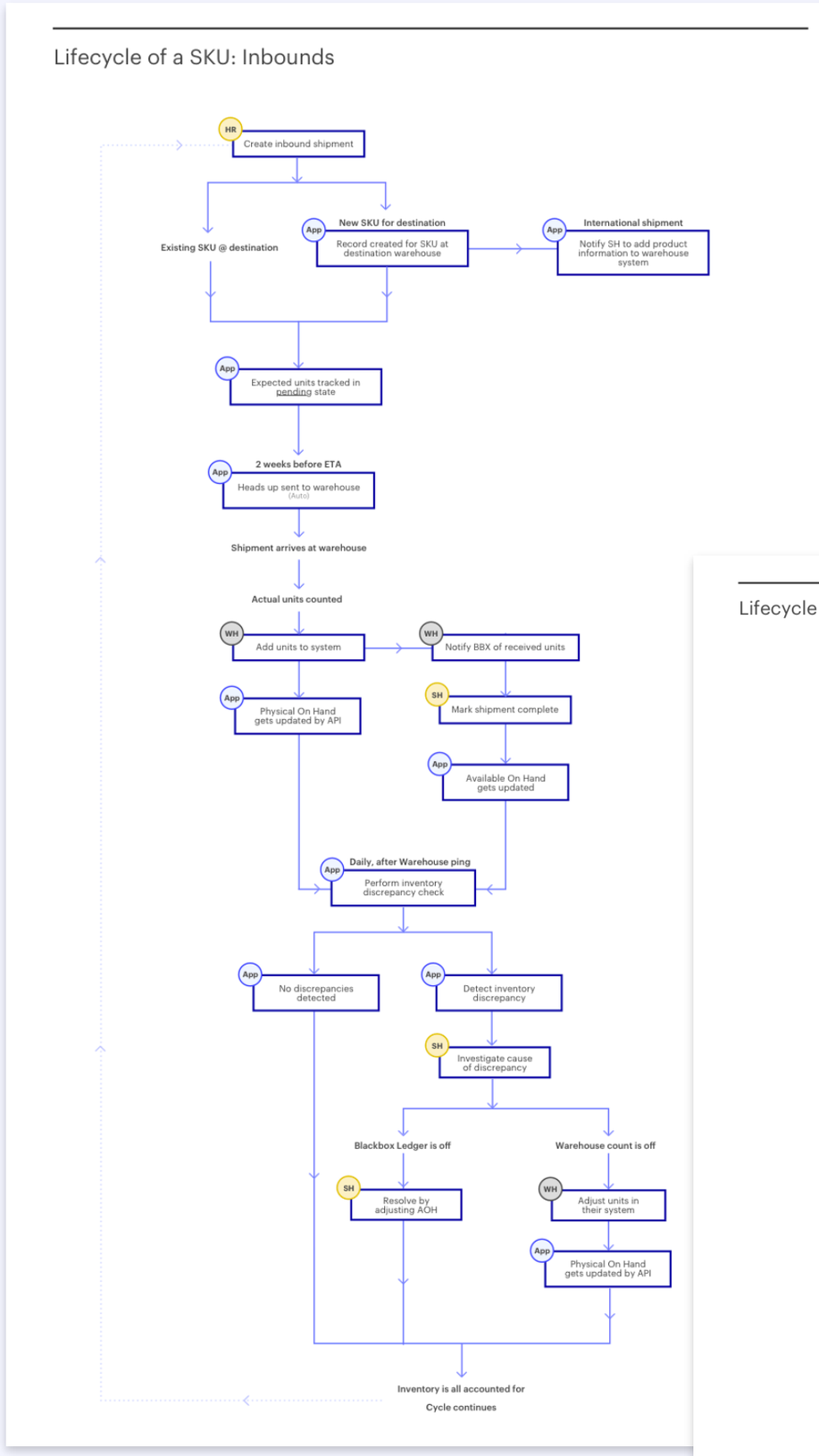
Visualizing the Adjusted Workflow for Stakeholders

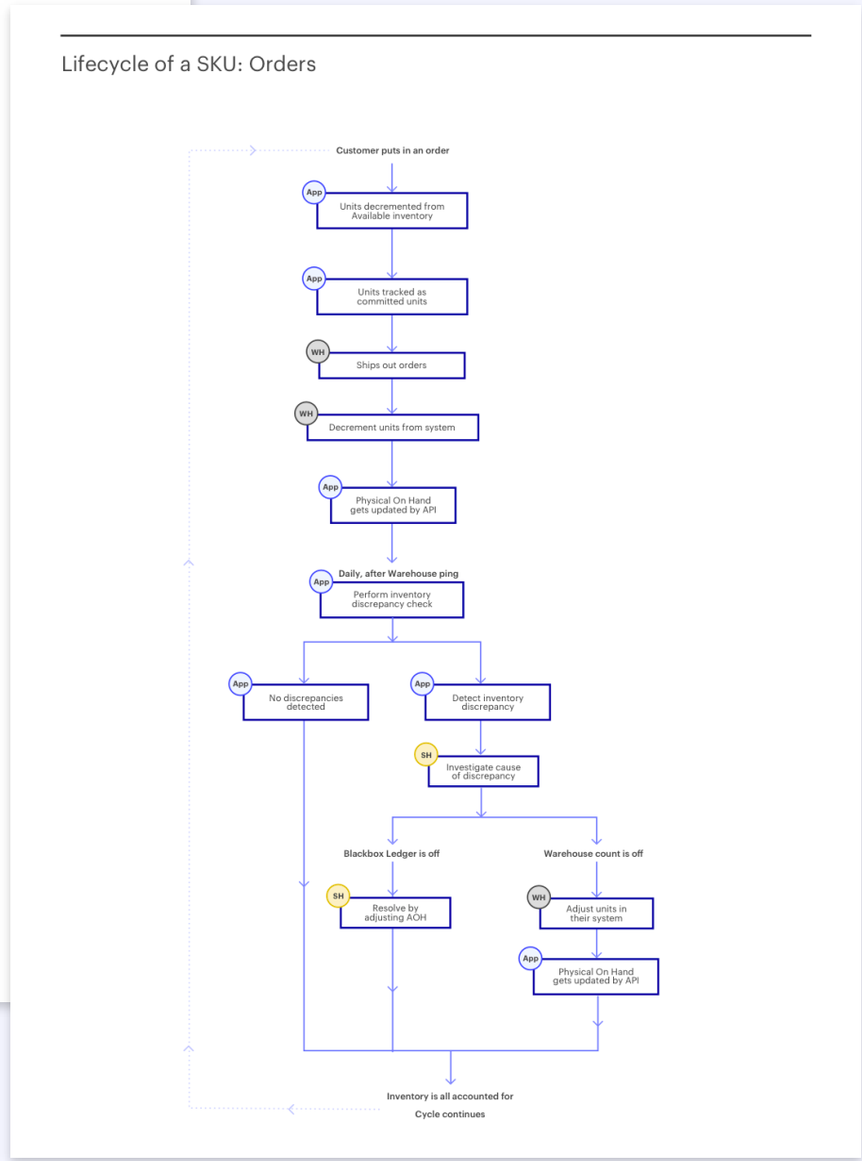
Stage: Ideation

At every stage of this process, assumptions and changes were validated with stakeholders regularly. Susie and I engaged in weekly check-ins regarding the proposed changes to the system of inventory tracking as well as her workflow.

This redesigned system, with automated inventory calculations and checkpoints, would mean fewer manual interventions to confirm unit counts and brings us one step closer to ensuring that the Blackbox IMS could be trusted as a source of truth.

The system will also automatically notify Susie to any discrepancies.





HR - Heather, Accounts Manager

SH - Susie, Logistics Manager

App - Blackbox Dashboard (automated)

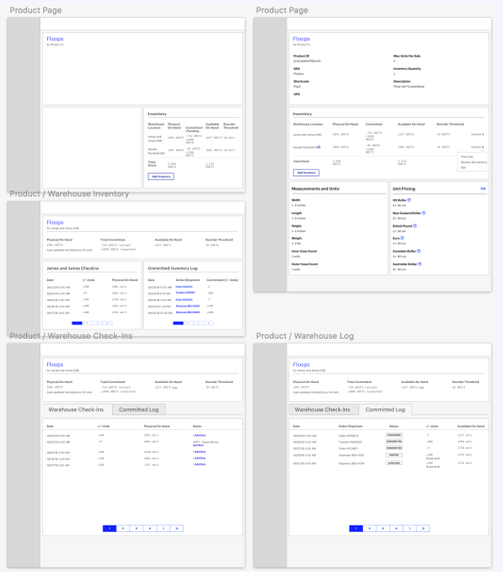
WH - Warehouse API (automated)

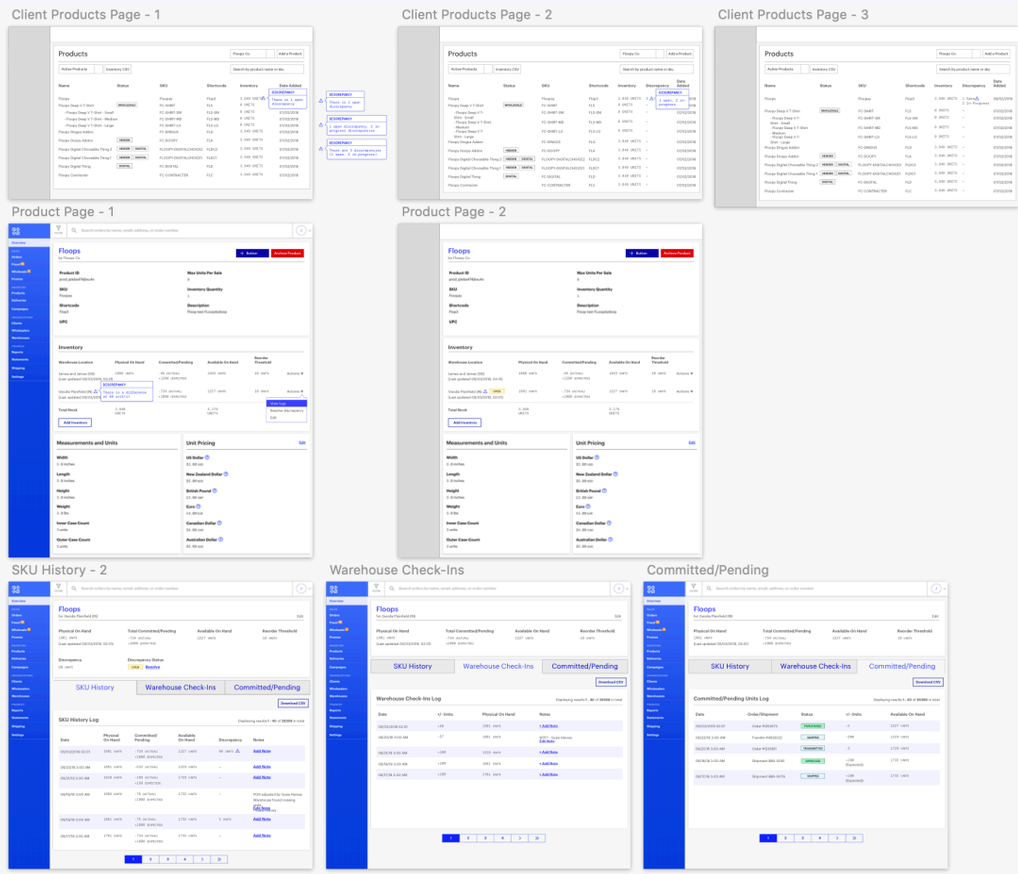
Creating Wireframes to Show Impacted or New Views

Stage: Ideation

Product information within the Blackbox system exists in a hierarchy. It was important to make sure any pertinent inventory notices were visible at high and low levels.

Impacted views included the client-product list, product pages, and individual product-warehouse inventory logs.

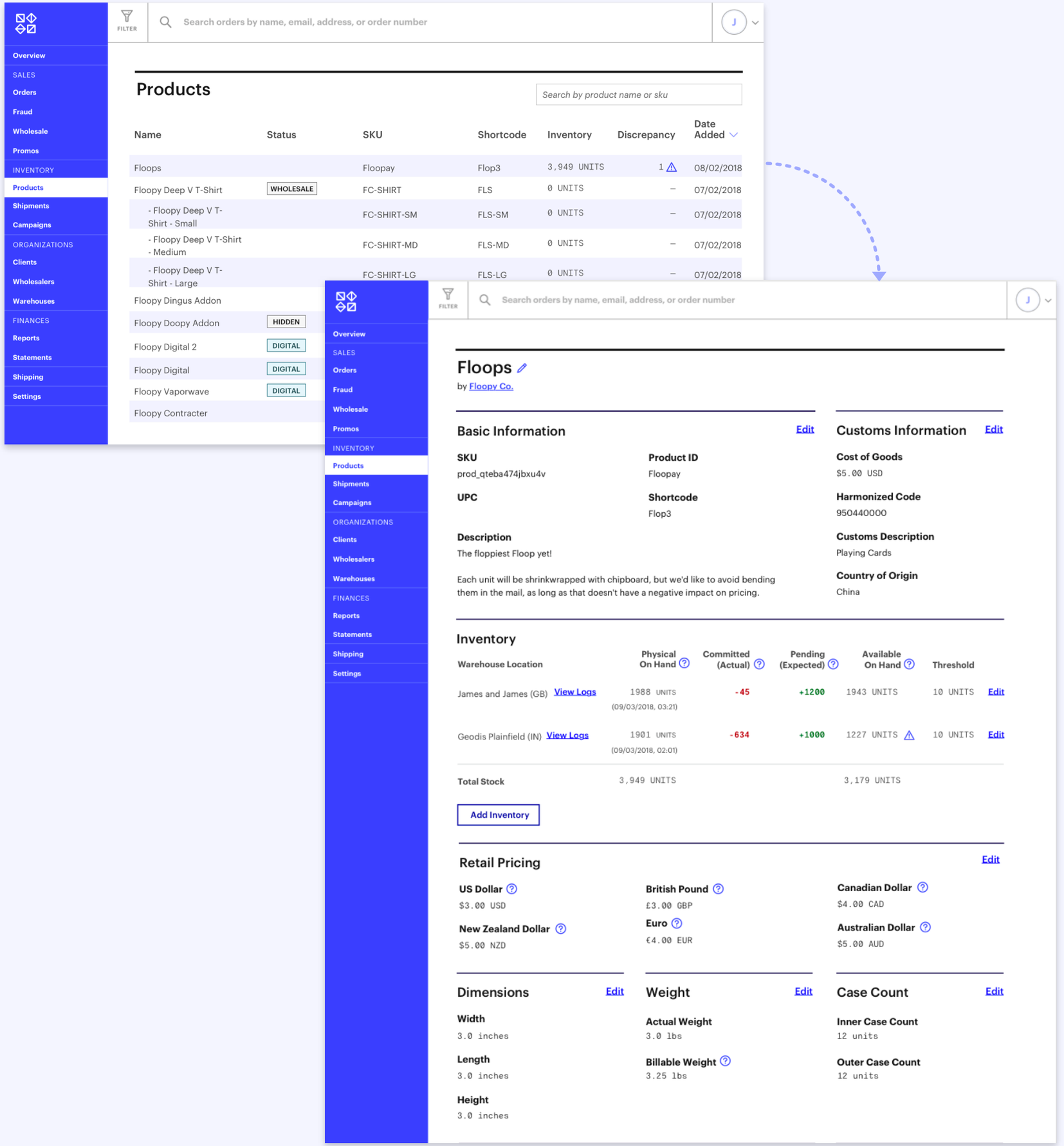




Higher Level View of Inventory and Potential Action Items

Product information is first seen at the client-product level. Here, Susie can see at a glance if there are any discrepancies that could require attention. This is noted with an alert and number of calculated discrepancies for the product.

Should Susie dig in further to the individual product page, she can see which warehouse's report deviates from what the Blackbox calculates for the inventory count. The newly separated out counts for Physical On Hand, Committed, Pending, and Available on Hand units are displayed. This makes it clear how many units can actually be decremented from for orders.

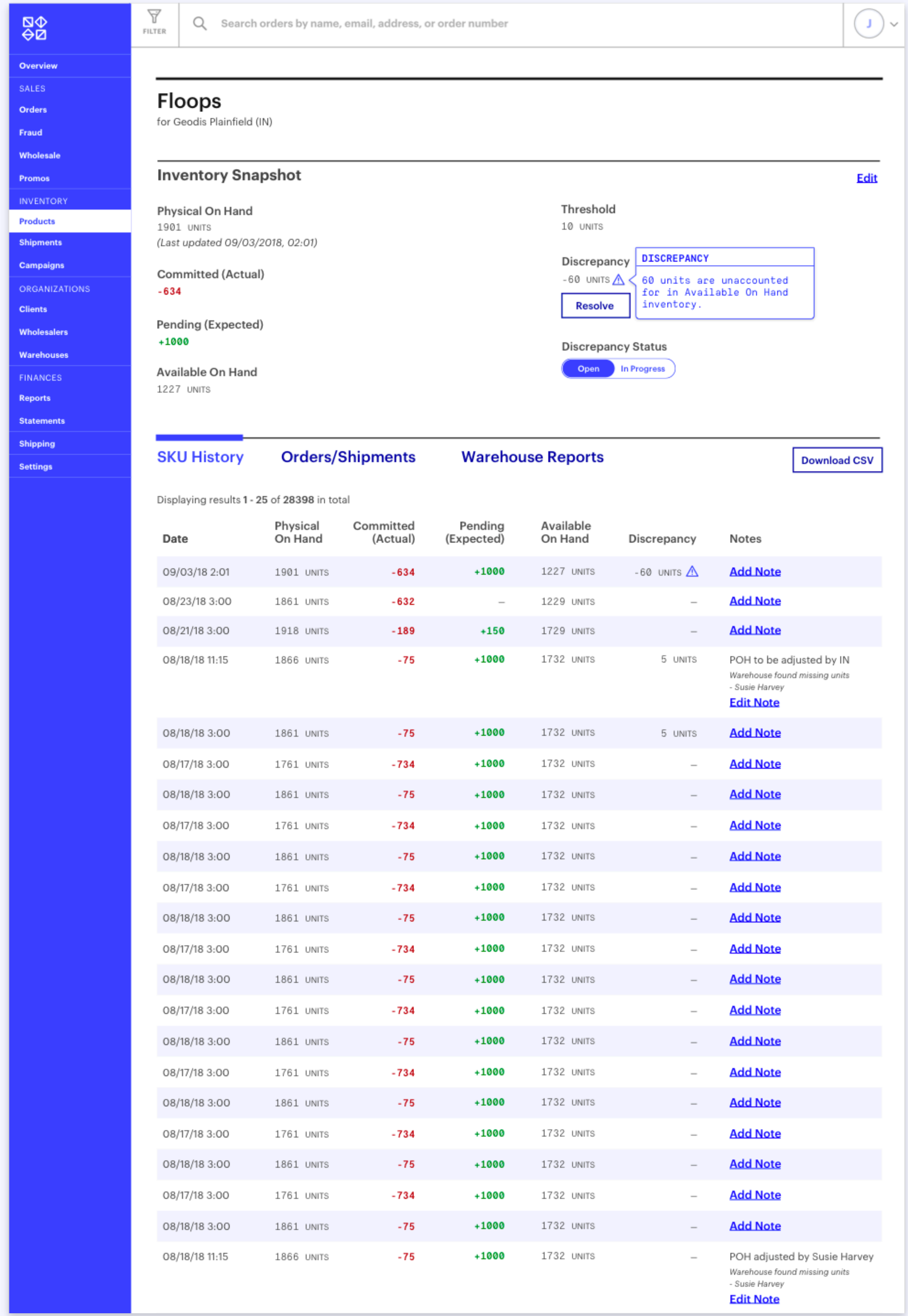


Inventory Snapshot at the Product-Warehouse Level

To begin investigating any discrepancies, Susie can go into logs of a product's inventory within any warehouse that has had that product on their shelves.

The product-warehouse view includes an up-to-date snapshot that clearly states how many actual units have been committed to orders or transfers, how many expected units are pending from inbound shipments, and whether there is an existing discrepancy.

Below, the new tab format shows SKU History, which is the log of all updates to quantity. Susie can utilize this view to get a running report of all inventory movement, and what might have triggered a discrepancy.



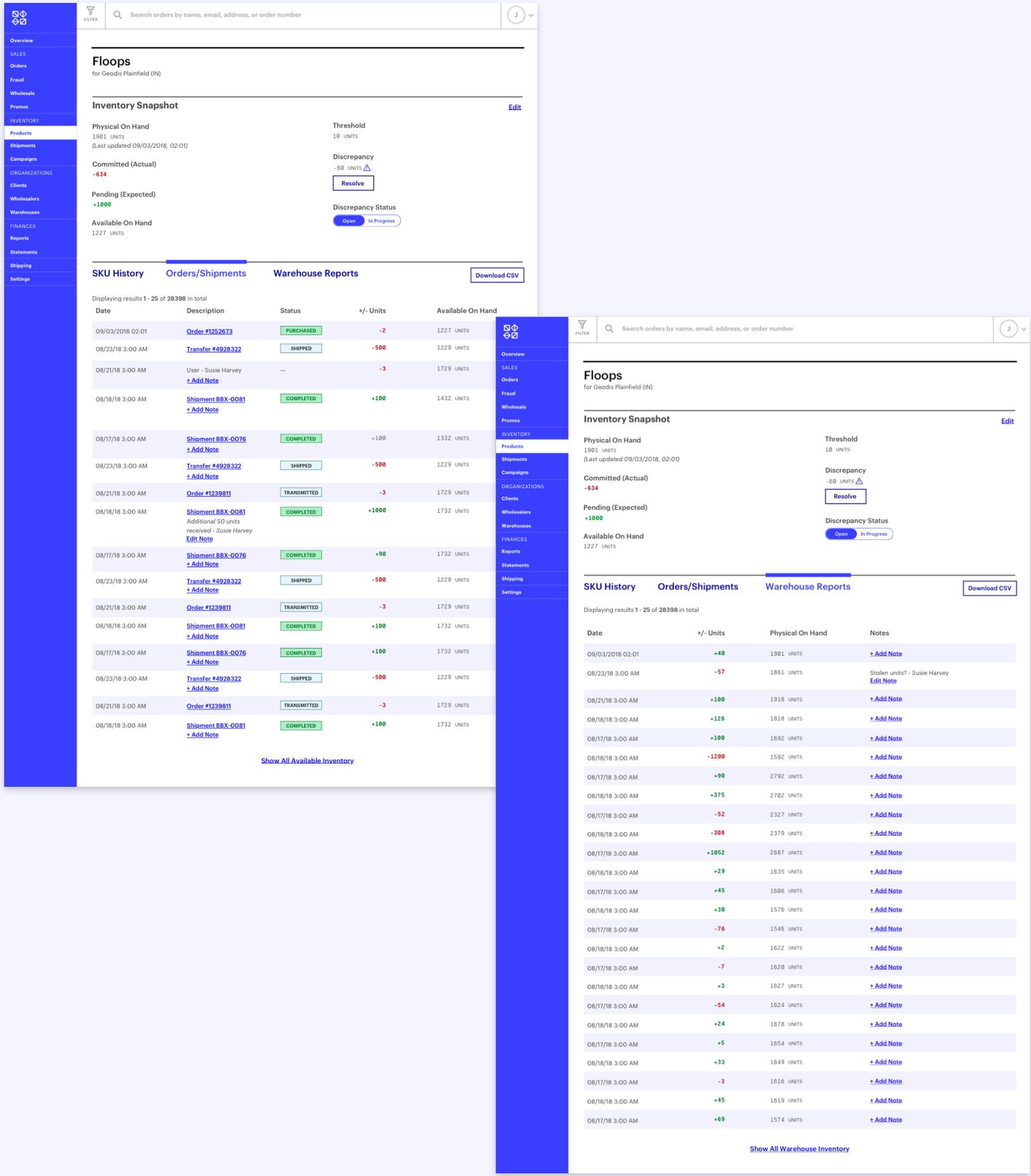
Detailed Tabs for Viewing Moving Units

Within the product-warehouse view, Susie can dig even further to additional detailed logs.

The Orders/Shipments tab is the running list of direct causes of stock movement with specific order or shipment IDs.

The Warehouse Reports tab displays the updated Physical On Hand inventory per warehouse API calls.

With this information, Susie and the team can get insights into the changes to inventory quantity and, should there be a descrepancy, be able to deduce the exact cause.

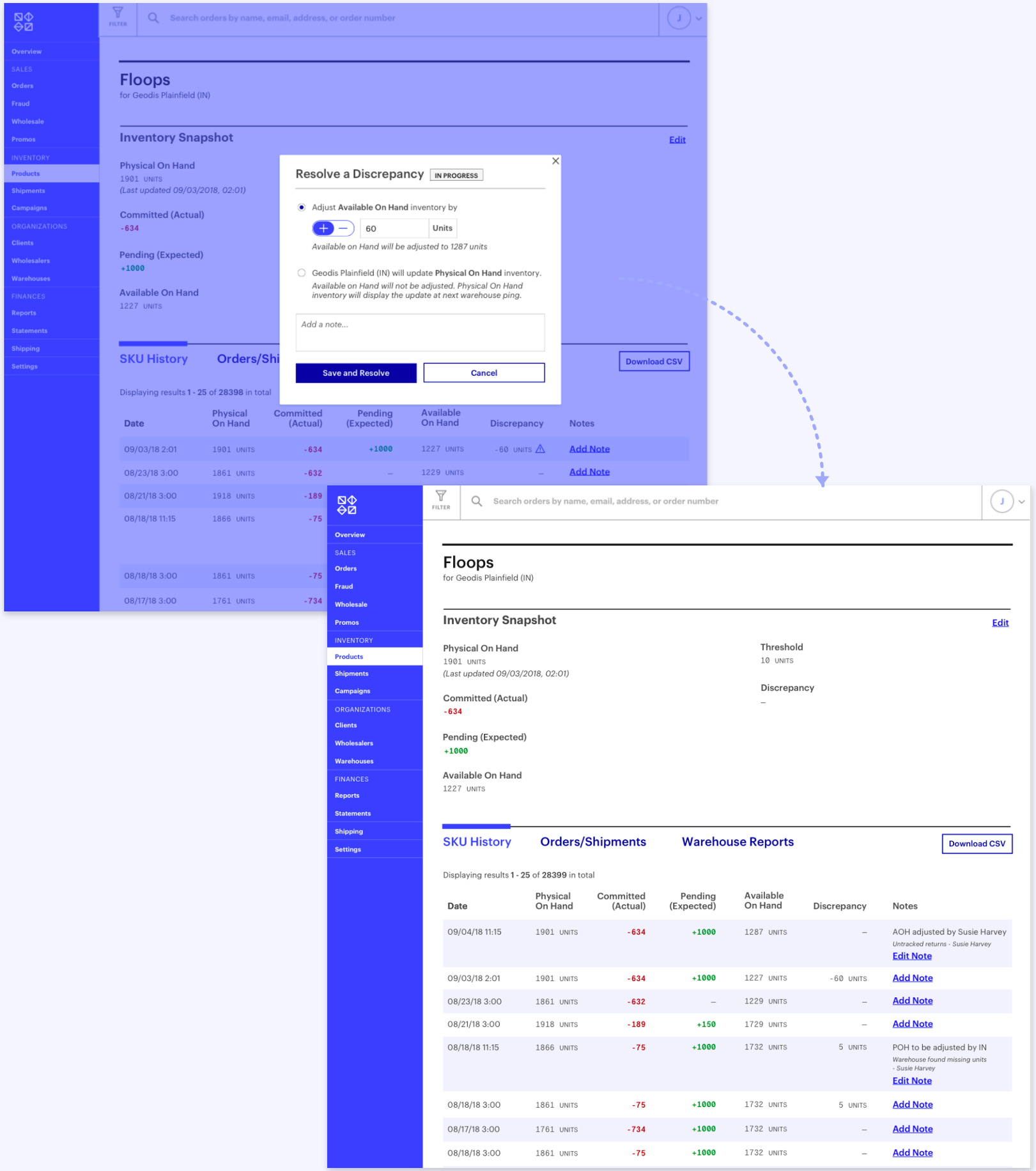


Resolving Inventory Discrepancies

The internal Logistics team will be notified about discrepancies with a daily digest email per partner warehouse.

Discrepancies can be resolved easily within a modal. If the discrepancy is calculated (Physical On Hand - Committed units = Available On Hand) to be +N number of units, it means there are excess units counted in Available on Hand. If there is a discrepancy of -N units, then there are excess units.

With any manual adjustment, a record of the resolution will be created in SKU history. For V1, resolutions will be used for learning where discrepancies tend to originate.



Revamped Component for the Design System

For the product-warehouse view, tabs were redesigned for the design system. Previously, they were large, divider-style tabs. There was no mobile-friendly version.

The new tabs are more space conscious and flexible. They make it easy to group and present different views within a shared context.

Full-width

Mobile

Results and Aftermath

This initiative was a really good exploration into the complexities regarding all the (literal) moving pieces of inventory. While this redesign is not yet pushed to production, it did highlight:

- The need to look into working with a warehouse that has more trustworthy tech and frequent API calls for more up-to-date data.

- That there needed to be a more streamlined and automated processes for inbound and transfer shipments to ensure lower lifts for the Logistics team. Managing new alerts to discrepancies would be difficult to add to the workload when ongoing shipments still needed manual intervention.

The follow-up roadmap items for the Blackbox team entailed:

- Hunting for a new partner warehouse with a focus on how their system would interact with ours. How might we use more detailed warehouse systems' data to automate inventory calculations where the Logistics team typically has to manually intervene?

- Cleaning up how inbound and transfer shipments increment and decrement inventory within our system.

This became a valuable look into what truly foundational features and business-impacting decisions were needed to ensure we could build competitive inventory tools.