Abstract: Three-hundred mm wafer fabrication factories will require the baseline capabilities of stocker storage and interbay transport. In addition to these baseline capabilities, intrabay transport will be added as a result of ergonomic and safety requirements brought about by the increased size and weight of 300 mm wafer carriers. To realize the full vision of cost-effective automated carrier transfer to and from production equipment, these stocker, interbay transport, and intrabay transport systems will be required to be fully integrated with each other and the factory host system in the 300 mm wafer fabrication factory.

The International 300 mm Initiative (I300I) and J300E have published Global Joint Guidance (GJG) item 6.2, “AMHS Framework,” which requires a SEMI standard to be developed that specifies the minimum functionality of the AMHS integration system and its interface to the factory host system. The purpose of this document is to record the requirements of such a standard, as jointly defined by the J300E Computer Integrated Manufacturing (CIM) Planning group and the I300I CIM Study Group. Please note that this document does not represent full consensus of all I300I/J300E companies. However, it is deemed useful as guidance to suppliers of equipment and factory systems and standards developers, and was approved for publication by the I300I Factory Integration Working Group.

Keywords: 300 mm Wafers, Stockers, Wafer Transport, Standards, Specifications, CIM, Safety, Frameworks

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1 INTRODUCTION

Three-hundred mm wafer fabrication factories will require the baseline capabilities of stocker storage and interbay transport. In addition to these baseline capabilities, intrabay transport will be added as a result of ergonomic and safety requirements brought about by the increased size and weight of 300 mm wafer carriers. These stocker, interbay transport, and intrabay transport systems will be required to be fully integrated with each other and the factory host system in the 300 mm wafer fabrication factory to realize the full vision of cost-effective automated carrier transfer to and from production equipment.

A baseline requirement of automated material handling system (AMHS) equipment is efficient integration with the host system. Therefore, the purpose of the AMHS Framework is to realize cost-effective integration of the interoperable AMHS systems (as illustrated in Figure 1). To this end, I300I and J300E have published Global Joint Guidance (GJG) item 6.2, “AMHS Framework,” which requires a SEMI standard to be developed that specifies the minimum functionality of the AMHS integration system and its interface to the factory host system. The purpose of this document is to record the requirements of such a standard, as jointly defined by the J300E CIM Planning group and the I300I CIM Study Group.

1.1 Objectives

The intention of this document is to collect, document, and communicate user requirements. After reading this document, you will be able to

- Define the assumptions to be used in developing the AMHS Framework Standard
- Define what the user is requesting in the AMHS Framework Standard

Figure 1 AMHS Framework
1.2 Section Descriptions

This document consists of two sections (not including this section); each is briefly described below:

- **Assumptions (Section 2)** – Defines the assumptions used in generating the user requirements.

- **Specific Requirements (Section 3)** – Defines the individual specific requirements for the AMHS Framework, detailing all the information that the end-user needs to meet product requirements.

1.2.1 Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0k</td>
<td>4/8/99</td>
<td>Dale Blackwell – International SEMATECH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dave Bloss – Intel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Karl Gartland – I300I/IBM</td>
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<tr>
<td></td>
<td></td>
<td>Junji Iwasaki – Mitsubishi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Koji Kitajima – Toshiba</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tomoyuki Masui – Hitachi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Margaret Pratt – International SEMATECH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jiro Yamamoto – NEC</td>
</tr>
</tbody>
</table>

1.3 Reference Documents


- SEMI E82-0299 – *Intrabay Specific Equipment Model (IBSEM).*

- SEMI E88-0999 – *Stocker Specific Equipment Model (stocker SEM).*


- SEMI Draft Doc 2824 – *CIM Framework Material Movement Group.*

- SEMI E87-0999 – *Provisional Specification for Carrier Transfer Standard (CTS).*
2 ASSUMPTIONS

2.1 Overview

2.1.1 Composition
In 300 mm wafer fabrication, functional area layouts where similar groups of processing equipment are located together in a single area will be adopted. Functional areas are further divided into groups of equipment called bays. The transportation system is composed of both interbay and intrabay transport devices.

Typically, a stocker is placed in each bay, which stores a certain amount of carriers and serves as a connection point between the interbay and intrabay transport systems. Overhead shutter (OHS), or monorail, is used to transfer carriers between stockers by using several vehicles along a rail. Devices that transfer carriers between the production equipment and stockers are referred to as overhead hoist transport (OHT), automated guided vehicle (AGV), rail guided vehicle (RGV), conveyor, and person guided vehicle (PGV). These types of intrabay transport equipment are typically chosen based upon bay characteristics. OHS, stockers, AGV, RGV, and OHT are called AMHS equipment. Interbay transport equipment, stocker equipment, and intrabay transport equipment communicate with the AMHS integration system to become an integrated system.

2.1.2 Transfer Objects
An example of an object being transferred by the AMHS is a wafer carrier, of which there are two types being considered for 300 mm wafer manufacturing. The first type is an open cassette (OC), which exposes wafers to the cleanroom, while the second type is a front opening unified pod (FOUP), which encloses wafers. In either case, an ID tag or label is placed on the carrier for identification. A single carrier may contain several lots with different processing requirements.

2.1.3 Operational Flow
A carrier that has been processed at a piece of production equipment is transferred to the nearest stocker by intrabay AMHS equipment such as an AGV or OHT. The factory host system determines the next process location for the carrier and moves the carrier from its current location in the source bay to a destination stocker in the next bay where processing must be performed.

Next, the carrier stored in the destination stocker is selected based on a request from the production equipment in the next process step. It is unloaded from the stocker, taken out of the stocker, and moved to the production equipment (intrabay-bay transfer). These are the sequence of carrier unload operations initiated by the next lot request from the production equipment. This is combined with the carrier storage operations to create a carrier transfer operation between production equipment in different bays and at different operations of the process flow.
2.2 Interoperable AMHS Guidelines

Guideline Text – 6.1 [Modified: C7]: Interoperable AMHS Equipment (Interbay and Intrabay)

IC manufacturers want to ensure the optimal AMHS solution for the overall factory to realize desired bay throughput, layout flexibility, and cost-effectiveness; 300 mm factories require the combination of different types of AMHS components from different suppliers to meet different material handling requirements. Standard communication protocols, state models, and interfaces are required to achieve these goals.

Requirements:
1. International participation is essential.
2. Increased Control of Factory Logistics and Production Scheduling
3. Factory Automation (FA)

Standards:
1. SEMI E5, E23, E30, E37, E37.1, E82, E88. Action required for SEMI to develop Specific Equipment Models (SEMs) for intrabay transport, interbay transport, and stockers. Action required for SEMI to develop communication interfaces and hardware interfaces between stockers and interbay transport systems.

References: I300I Factory Guideline 2.13

Recommendations: AMHS equipment suppliers should be involved in the standards development.

![Figure 2 AMHS Interoperability](path_to_image)
Guideline Text – 6.2 [New]: AMHS Framework

Semiconductor factories that have AMHS require an integration software system to realize automated material movement. The AMHS integration system must be interoperable with AMHS equipment controller and host systems from different suppliers. To achieve this goal, the AMHS integration system must conform to standard communication protocols, state models, and interfaces. This includes coordination and integration of AMHS equipment as well as integration with the factory host systems.

Requirements:
3. International participation is essential.
9. Increased control of factory logistics and production scheduling
11.3 Factory automation (FA)

Standards:
SEMI E5, E30, E37, E37.1, E81, E88, PR5, Doc 2824. Action required for SEMI to develop standard communication interfaces between AMHS integration systems and host system software layers.

References: None

Recommendations: The minimum recommended functionality of the AMHS integration system is to determine AMHS routes and issue transfer commands to the AMHS equipment. AMHS equipment suppliers, AMHS integration system suppliers and host system suppliers should be involved in the standard’s development.

2.3 Functional Assumptions

- The AMHS integration system does not determine the destination production equipment. The destination piece of production equipment is an input to the AMHS integration system.
- The AMHS integration system does not determine the destination stocker except in the case of stocker groups.
- The AMHS integration system does not directly control production equipment even if the control relates carrier transfer (for instance, internal buffer control).
- The AMHS equipment connected to the AMHS integration system have standard communication interface conforming to IBSEM, stocker SEM, or TSSEM.
- The production equipment is not connected to the AMHS integration system.
- The AMHS integration system must not control the dispatch of carriers (including empty carriers).

2.4 Performance
TBD
3 SPECIFIC REQUIREMENTS

3.1 Functional Requirements

3.1.1 AMHS Route Determination

- The AMHS integration system shall determine the AMHS route between different pieces of AMHS and/or production equipment for AMHS moves.
- The AMHS integration system shall reserve stocker locations for carriers after route selection.

![AMHS Route Determination](image)

**Figure 3** AMHS Route Determination

3.1.2 AMHS Route Determination (Advanced)

The AMHS integration system shall determine the AMHS route between different pieces of AMHS and/or production equipment for AMHS moves dynamically, considering the following circumstances:

- AMHS equipment status
- AMHS carrier movement (carrier traffic)

![AMHS Route Determination (Advanced)](image)

**Figure 4** AMHS Route Determination (Advanced)
3.1.3 AMHS Equipment Interface

- The AMHS integration system shall issue transfer commands to the intrabay transport system controller, interbay transport system controller, and stocker controller.
- The AMHS integration system shall convert protocols between the entities with which it interfaces.
- These transfer commands shall comply with the SEMI standards shown in Table 2.

### Table 2 AMHS Equipment Interface SEMI Standards Requirements

<table>
<thead>
<tr>
<th>Standard</th>
<th>AMHS Equipment Controller Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMI E82 – IBSEM</td>
<td>Intrabay Transport Equipment Controller</td>
</tr>
<tr>
<td>SEMI E88 – Stocker SEM</td>
<td>Stocker Controller</td>
</tr>
<tr>
<td>SEMI E82 – IBSEM</td>
<td>Interbay Transport Equipment Controller</td>
</tr>
</tbody>
</table>

![Figure 5 Example of the AMHS Integration System Issuing Transfer Commands to AMHS Controllers](image)

3.1.4 Transfer Command Prioritization

The AMHS Integration system shall issue transfer commands in accordance with at least the following priorities:

- FIFO (First In, First Out)
- Carrier Priority
- User Defined
- Supplier Defined

The order of execution of these priorities shall be user-defined.
3.1.5 Carrier Transfer Delivery Grouping

The AMHS integration system shall support carrier transfer grouping by the host system. In this case, one macro transfer command from the host shall contain all carrier ID’s in the host carrier transfer group. The AMHS integration system shall coordinate delivery of all carriers in the group, considering efficient input and output from both destination and source, such as by the same vehicle, within the bounds of any AMHS equipment height/width (H/W) limitation. The AMHS Integration system shall notify the host when all carriers have been delivered. Figure 6 contains an example of this requirement.

The AMHS integration system shall allow carriers from more than one macro transfer command to be grouped on the same AMHS vehicle. The AMHS integration system shall notify the host in this case. Figure 7 contains an example of this requirement.

![Figure 6: Example of Host Specified Carrier Transfer Delivery Grouping](image)

![Figure 7: Example of AMHS Integration System Carrier Transfer Delivery Grouping](image)

3.1.6 Stocker Overflow Control

- The AMHS integration system shall make the determination to transfer a carrier to a substitute stocker or keep a carrier in its current stocker when the destination stocker cannot accept carriers.
• The AMHS integration system shall make the determination to return a carrier to the originally designated stocker when that stocker becomes to be able to accept carriers.

• The AMHS integration system shall make the determination to deliver to a substitute stocker or keep a carrier in its current stocker, according to a configurable set of criteria. The minimum set of criteria is as follows:
  – Stocker status (per stocker SEM)
  – Stocker logical partition capacity and carrier attributes

Figure 9 illustrates this requirement.

• The AMHS integration system shall use carrier attributes to determine if a carrier should be delivered to a substitute stocker or be kept in its current stocker in an overflow condition. Figure 10 illustrates this requirement.

• The designation of all substitute stockers shall be user configurable within the AMHS integration system. The current stocker can be considered a substitute stocker.

• The AMHS integration system shall notify the host when an overflow occurs and terminates.

\[ \text{Destination Stocker} \]

\[ \text{Substitute Stocker} \]

**Figure 8**  Stocker Overflow Control

\[ \begin{array}{c|c|c|c|c|}
\hline
\text{Name} & \text{Size} \\
\hline
A & 4 \\
B & 4 \\
C & 1 \\
Stock-In & 12 \\
Relay & 5 \\
Common & 35 \\
\hline
\end{array} \]

**Figure 9**  Substitute Stocker Determination Using Logical Partitions and Carrier Attributes
3.1.7 Cancel, Abort, and Modify Macro Transfer Requests

- The AMHS integration system shall be able to respond to requests from the host to cancel, abort, and modify the original macro transfer requests sent by the host system.

- The AMHS integration system shall accept pause execution requests for a macro transfer request to modify it. Modification from the host shall be accepted when the macro transfer request is in a paused state. If modification can be achieved by using both cancellation and re-creation by the host, then the modification command is not necessary.

- The AMHS integration system shall be able to initiate cancel and initiate abort of the original macro transfer requests issued by the host. The AMHS integration system shall not modify macro transfer requests.

3.1.8 Manual Carrier Input

- The AMHS integration system shall allow operators to input a carrier into a stocker manually, without previous host notification.

- The AMHS Integration system shall notify the host in this case.

3.1.9 AMHS Equipment Monitoring

- The AMHS integration system shall monitor the status of each piece of AMHS equipment and access to that information shall be provided to the host via standard interfaces.

- Managing the history of AMHS equipment status changes is an optional requirement for the AMHS integration system.

- If the AMHS integration system manages the history of AMHS equipment status changes and AMHS equipment statistics, then access to that information shall be provided to the host via standard interfaces.
3.1.10 Carrier Tracking

- The AMHS integration system shall monitor the AMHS location of each carrier.
- The AMHS integration system shall report the AMHS location of each carrier to the host every time the location changes to a different piece of AMHS equipment controlled by a different system controller (i.e., different stocker, different Intrabay TSC, etc.).
- Managing the history of changes in location of carrier and carrier statistics is an optional requirement for the AMHS integration system.
- If the AMHS integration system manages the history of changes in location of carrier and carrier statistics, then access to that information shall be provided to the host via standard interfaces.

Carrier tracking location data resolution is contained in Table 3.

<table>
<thead>
<tr>
<th>AMHS Location</th>
<th>AMHS Integration System Data Resolution</th>
<th>Host Data Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport System Controller ID</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Transport Vehicle ID</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Stocker ID</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Stocker Shelf Location</td>
<td>Optional</td>
<td>No</td>
</tr>
<tr>
<td>Stocker Port Location</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

3.1.11 Transfer Execution Monitoring

- The AMHS integration system shall be able to accept a time constraint from the host system as part of the macro transfer command.
- The AMHS integration system shall contain configurable time constraints for transfer commands to the AMHS equipment.
- The AMHS integration system shall monitor macro commands from the host and transfer commands to the AMHS equipment and inform the host when a carrier transfer is not executed in a specified time (macro commands) or configured time (transfer commands).
- The AMHS integration system shall report that knowledge when it first becomes known, whether that is
  - At the initiation of the request
  - At some time during the transfer
  - Upon expiration of the time constraint

- This requirement is OPEN pending dispatching and scheduling URD completion. The AMHS integration system shall optionally support host queries of the following forms:
  - Provide an estimated amount of time for movement of specified material from a source to a destination.
  - Provide a yes or no response to the ability to move material from a source to a destination within a specified amount of time.
- Provide a yes or no response to the ability to move material from a source to a destination by a specific time. This requirement implies synchronized clocks across the host, AMHS integration systems and its components.

**This requirement is OPEN pending dispatching and scheduling URD completion.** The host system should understand that yes or no responses are not a guarantee of delivery within the specified constraints but only an acknowledgement of whether it could or could not be completed "on average."

**This requirement is OPEN pending dispatching and scheduling URD completion.** To do this, the AMHS integration system shall (optionally)
- Maintain statistics on its material transfer execution times including, but not limited to, such statistics as minimum transfer time, maximum transfer time and average transfer time.
- Maintain these statistics on a route basis, as there may be several potential routes between single sources and destinations.
- Base responses to the above queries on the availability of routes at the time of the query.

3.1.12 AMHS Equipment Configuration

- The AMHS integration system shall allow users to configure information about connected AMHS equipment. Refer to section 3.2, Data Requirements, for detailed data descriptions.

3.1.13 Stocker Groups

- The AMHS integration system shall support logical grouping of stockers according to the following criteria:
  - The host may address delivery to a logical group of stockers.
  - The host may address delivery to a prioritized set of individual stockers.
  - The AMHS integration system shall level carrier delivery according to a configurable set of criteria. The minimum set of criteria is as follows:
    - Stocker status (per stocker SEM)
    - Stocker logical partition capacity
    - Stocker work queue level
  - The AMHS integration system shall notify the host system of the final carrier location.
A Macro transfer request is received from the Host System:

- **Carrier:** Carrier A
- **Src:** Stocker 1
- **Dest:** Group 1

The AMHS Integration System determines the actual destination Stocker via configurable criteria:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Stocker 2</th>
<th>Stocker 3</th>
<th>Stocker 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>Up</td>
<td>Up</td>
<td>Down</td>
</tr>
<tr>
<td>Partition Capacity</td>
<td>10% full</td>
<td>20% full</td>
<td>20% full</td>
</tr>
<tr>
<td>Work Queue</td>
<td>0</td>
<td>2 jobs waiting</td>
<td>0</td>
</tr>
</tbody>
</table>

AMHS Integration System notifies the Host of the final Carrier destination:

- **Carrier:** Carrier A
- **Dest:** Stocker 2

---

**Figure 11**  Example of Stocker Groups

**3.1.14 Local Operation Interface**

- The AMHS integration system interface to the host shall not preclude a user interface implementation of host functionality.
- The AMHS integration system shall allow implementation of a user interface with the ability to issue micro transfer commands.

**3.1.15 Multiple AMHS Integration Systems**

- Multiple instances of the AMHS integration system shall be allowed in one logical factory environment.
- If multiple AMHS integration systems exist in one logical factory environment, there shall be one common integration point for which the host may interact.
- The common integration point shall provide the AMHS integration system interface to the host.

---

**Figure 12**  Multiple AMHS Integration Systems
3.1.16 Error Recovery

- The AMHS integration system shall execute the stocker SEM and IBSEM synchronization routines upon system (TSC or AMHS integration) startup or system recovery.

- The AMHS integration system shall execute a synchronization sequence with the host system upon system (host or AMHS integration) startup or system recovery.

- Manual recovery scenarios shall follow alarm scenarios defined in the stocker and IBSEM standards.
  - Manual data maintenance shall be required between the AMHS integration system and the operator in the case of manual error recovery.

- Automatic recovery scenarios shall be based on AMHS and production equipment errors.
  - If the AMHS vehicle with the carrier has no error, the AMHS integration system shall determine a substitute route for the carrier and modify the TSC’s transfer command.
  - Once the carrier has completed the substitute route, the AMHS integration system shall either wait for host instruction for that carrier, or move the carrier back to its original destination once the error has been cleared.

3.1.17 Controlled Shutdown

- The AMHS integration system shall stop and resume the transfer operation at the stocker shelf or at the sources that are specified by the host’s macro transfer request by the following controlled gate.

- NOTE: Requirements for the host have been listed here for completeness only.
### Table 4  Controlled Shutdown Requirements

<table>
<thead>
<tr>
<th>Use Origin</th>
<th>Reason</th>
<th>Controlled Gate Content</th>
<th>Scope</th>
<th>Controller</th>
<th>Control Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Equipment</td>
<td>Scheduled Down</td>
<td>Stop Carrier Dispatch (Stop Equip-In)</td>
<td>For each equip.</td>
<td>Host</td>
<td>By the equip.</td>
</tr>
<tr>
<td></td>
<td>State Abnormal</td>
<td>Stop Dest.Dispatch (Stop Equip-Out)</td>
<td>For each equip.</td>
<td>Host</td>
<td>By the equip.</td>
</tr>
<tr>
<td>Bay</td>
<td>Scheduled Down</td>
<td>Stop Carrier Dispatch (Stop Equip-In)</td>
<td>For all equip. In the bay</td>
<td>Host</td>
<td>By the bay</td>
</tr>
<tr>
<td>Line</td>
<td>Scheduled Down</td>
<td>Stop Carrier Dispatch (Stop Equip-In)</td>
<td>For all equip. In the line</td>
<td>Host</td>
<td>By the line</td>
</tr>
<tr>
<td>Intrabay Transport</td>
<td>Scheduled Down</td>
<td>Stop Stock-Out</td>
<td>For all related stockers</td>
<td>AMHS integration system</td>
<td>By the intrabay transport</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stop Stock-In</td>
<td>For all related stockers</td>
<td>AMHS integration system</td>
<td>By the intrabay transport</td>
</tr>
<tr>
<td>Stocker</td>
<td>Scheduled Down</td>
<td>Stop Bay-In</td>
<td>For each stocker or each stocker and its bay-in port</td>
<td>AMHS integration system</td>
<td>By each stocker or each stocker and its bay-in port</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stop Stock-Out</td>
<td>For each stocker or each stocker and its stock-out port</td>
<td>AMHS integration system</td>
<td>By each stocker or each stocker and its stock-out port</td>
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<tr>
<td></td>
<td></td>
<td>Stop Stock-In</td>
<td>For each stocker or each stocker and its stock-in port</td>
<td>AMHS integration system</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Stop Bay-Out</td>
<td>For each stocker or each stocker and its bay-out port</td>
<td>AMHS integration system</td>
<td>By each stocker or each stocker and its bay-out port</td>
</tr>
<tr>
<td>Interbay Transport</td>
<td>Scheduled Down</td>
<td>Stop Bay-Out</td>
<td>For all related stockers</td>
<td>AMHS integration system</td>
<td>By the interbay transport</td>
</tr>
</tbody>
</table>
3.2 Data Requirements

This section describes the required data elements that are to be available for the AMHS integration system. Table 4 maps these data items to specific functional requirements described in section 3.1.
3.2.1 Carrier Transfer

- Carrier ID
- Carrier destination (stocker or production equipment)
- Carrier priority
- Carrier attribute
- Target carrier transfer completion time

3.2.2 Equipment Status

- Production equipment status (UP, DOWN)
- Production equipment load port status (states defined in SEMI E87)
- Access Mode (MANUAL, AUTO)

3.2.3 Carrier Location

- Stocker ID
- Shelf location (optional)
- Production equipment ID
- Port location
- Transport system controller (TSC) ID

3.2.4 AMHS Equipment Capacity

- Logical stocker partition size
- Physical stocker capacity size
- Number of full stocker shelf locations in each stocker partition
- Number of empty stocker shelf locations in each stocker partition
- Number of stockers
- Physical vehicle capacity size
- Number of vehicles

3.2.5 AMHS Equipment Status

- AMHS equipment status (defined in SEMI E82 and E88)
- AMHS equipment TSC work queue level (number of queued transfer commands)
- AMHS transfer command status (defined in SEMI E82 and E88)

3.2.6 Route Map

- Logical connectivity of interbay and intrabay AMHS components
- Physical connectivity of interbay and intrabay AMHS components
- Information for route selection
### 3.3 Functional Requirements and Data Requirements Mapping

Table 5 provides the mapping of functional requirements to data requirements for the AMHS integration system. An X indicates data is required for the associated function.

<table>
<thead>
<tr>
<th>Data Requirements</th>
<th>3.2.1</th>
<th>3.2.2</th>
<th>3.2.3</th>
<th>3.2.4</th>
<th>3.2.5</th>
<th>3.2.6</th>
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<tbody>
<tr>
<td>3.2.1 Carrier Transfer</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>3.2.2 Equipment Status</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>3.2.3 Carrier Location</td>
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<td>3.2.4 AMHS Equipment Capacity</td>
<td></td>
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<td>3.2.5 AMHS Equipment Status</td>
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<td>3.2.6 Route Map</td>
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</table>

<table>
<thead>
<tr>
<th>Function Requirements</th>
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<th>O</th>
<th>I</th>
<th>O</th>
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<td>X</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<td>3.1.4 Transfer Command Prioritization</td>
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<td>3.1.5 Carrier Transfer Delivery Grouping</td>
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<tr>
<td>3.1.6 Stocker Overflow Control</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>3.1.7 Cancel, Abort, and Modify Macro Transfer Requests</td>
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<td>X</td>
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<td>3.1.8 Manual Carrier Input</td>
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<td>X</td>
<td>X</td>
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<td>X</td>
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<td>3.1.9 AMHS Equipment Monitoring</td>
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<td>X</td>
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<td>3.1.10 Carrier Tracking</td>
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<td>3.1.11 Transfer Execution Monitoring</td>
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<td>3.1.12 AMHS Equipment Configuration</td>
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<td>3.1.13 Stocker Groups</td>
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</tr>
<tr>
<td>3.1.14 Local Operation Interface</td>
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<td>3.1.15 Multiple AMHS Integration Systems</td>
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<td>3.1.16 Error Recovery</td>
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<td>X</td>
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</tr>
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<td>3.1.17 Controlled Shutdown</td>
<td>X</td>
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</tr>
</tbody>
</table>
Figure 15 also illustrates the mapping of functional requirements and data requirements in a logical format.

**Functions/Data Mapping**

![Diagram of Functions/Data Mapping]

**Figure 15**  Functional Requirements and Data Requirements Mapping

4 **SCENARIOS**

This section contains four scenarios that illustrate selected requirements contained in this user requirements document.

4.1 **Background**

This section describes background information related to the scenarios themselves. Figure 16 represents the layout used for all four scenarios, Table 6 outlines the four scenario cases that will be shown, and Table 7 maps scenario cases to user requirements.
Table 6  Scenario Case Conditions

<table>
<thead>
<tr>
<th>Case</th>
<th>Source</th>
<th>Destination</th>
<th>Batch Size</th>
<th>Route/Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>Eq1</td>
<td>Stk7</td>
<td>1 Carrier</td>
<td>Eq1&gt;Agt1&gt;Stk2&gt;Eq2&gt;Stk8 (Relay)&gt;Ohs1&gt;Temp&gt;Stk7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stk8</td>
<td></td>
<td>Stk2&gt;Stk4&gt;Stk5&gt;Stk6</td>
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</tbody>
</table>
### Table 7  Scenario Requirement Mapping

<table>
<thead>
<tr>
<th>#</th>
<th>Requirement</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>AMHS Route Determination</td>
<td>Yes</td>
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<td>Yes</td>
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<tr>
<td></td>
<td>AMHS Route Det. Advanced</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td>AMHS Equip Interface</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td>Tr Command Prioritization</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Carrier T.D.G</td>
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<td>Yes</td>
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</tr>
<tr>
<td></td>
<td>Stocker Overflow Control</td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Cancel, Abort, and Modify</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manual Carrier Input</td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
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<tr>
<td></td>
<td>AMHS Equip Monitoring</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carrier Tracking</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tr Execution Monitoring</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AMHS Equip Configuration</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Stocker Groups</td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Local Operation Interface</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comm. between AMHS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Error Recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Controlled Shutdown</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
4.2 Scenario Case 1

**User Requirements Item (Underline)**

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Integrator</th>
<th>TSC</th>
<th>Equip</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMHS Equip Status</td>
<td>T1. AMHS Equip Monitoring</td>
<td>T1. Report TSC State</td>
<td>AMHS Equip Status</td>
</tr>
<tr>
<td>Proc. Equip Status</td>
<td>E1. AMHS Equip Status Eq1</td>
<td>E2. Report Equip Status Eq1</td>
<td>E2. Ready to Unload Eq1</td>
</tr>
</tbody>
</table>

**IN Data**

- S1. Monitor Equip Status
- S2. Determine Next Process/Equip
- S3. Destination Dispatch
  1) Determine Destination (Stk7,8)
  2) Issue Macro Command
  (Lot ID = AAA Port No.)

**OUT Data**

- T2. Report Tr Cmd State
- T2. Tr Execution Monitoring

**Supervisor**

- Carrier Transfer
- Carrier Location
- Route Map
- AMHS Equip Cap.
- Proc. Equip Status
- AMHS Equip Status

**Integrator**

- I2. AMHS Route Det./Stocker Groups
  1) Select AMHS Route
  2) Check 1st Storage Logical Partition (L-P/T) Capacity (for Stock-In) and Select 1st Storage
  3) Reserve 1st Storage L-P/T Capacity (Stk2’s Stock-In)
- I3. AMHS Equip Interface
  1) Check Equip Status (Eq1, Agt1, Stk2), If no good take a branch
  2) Issue Transfer Command
  (Carrier ID = aaa Src = Eq1/Port Dest = Stk7,8)
- I4. Tr Execution Monitoring

**TSC**

- AMHS Equip Cap.

**Equip**

- AMHS Equip Status (Work Queue Add)
- Agt1
- T2. Report Tr Cmd State
<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Integrator</th>
<th>TSC</th>
<th>Equip</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMHS Equip Status</td>
<td>15. AMHS Equip Monitoring</td>
<td>T3. Report Vehicle State</td>
<td>AMHS Equip Status</td>
</tr>
<tr>
<td>Carrier Location</td>
<td>16. Carrier Tracking</td>
<td>T4. Report Carrier State</td>
<td>Carrier Location</td>
</tr>
<tr>
<td>AMHS Equip Status</td>
<td>17. Update AMHS Equip Status</td>
<td>T5. Report Comp. (Agt1)</td>
<td>AMHS Equip Status (Work Queue Delete)</td>
</tr>
<tr>
<td>AMHS Equip Status</td>
<td>18. AMHS Equip Interface</td>
<td></td>
<td>Stk2 (Detail See SEM)</td>
</tr>
</tbody>
</table>

1) Check Equip Status (Stk2)
2) Issue Transfer Command

(Carrier ID = aaa Stock-In L-P/T = Stock-In)

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Integrator</th>
<th>TSC</th>
<th>Equip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier Transfer</td>
<td>19. Tr Execution Monitoring</td>
<td>T6. Report Tr Cmd State</td>
<td>Carrier Transfer</td>
</tr>
<tr>
<td>AMHS Equip Status</td>
<td>20. AMHS Equip Monitoring</td>
<td>T7. Report Crane State</td>
<td>AMHS Equip Status</td>
</tr>
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<td>Carrier Location</td>
<td>111. Carrier Tracking</td>
<td>T8. Report Carrier State</td>
<td>Carrier Location</td>
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<tr>
<td>AMHS Equip Cap.</td>
<td>112. Update Stocker Capacity</td>
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<td>AMHS Equip Cap.</td>
</tr>
<tr>
<td>AMHS Equip Status</td>
<td>113. Update AMHS Equip Status</td>
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<td>AMHS Equip Status (Work Queue Delete)</td>
</tr>
</tbody>
</table>
### Supervisor
- Carrier Transfer
- Carrier Location
- Route Map
- AMHS Equip Cap.

### Integrator
- **T14. AMHS Route Det.**
  1. Select AMHS Route
  2. Check 2nd and 3rd Storage L-P/T Capacity (2nd Storage for Relay and 3rd Storage for Photo1) and Select them
  3. Reserve 2nd and 3rd Storage L-P/T Capacity (Stk4’s Relay and Stk7’s Photo1)
- **T15. AMHS Equip Interface**
  1. Check Equip Status (Stk2)
  2. Issue Transfer Command (Carrier ID = aaa Bay-Out)
- **T16. Tr Execution Monitoring**

### TSC
- AMHS Equip Cap.

### Equip
- AMHS Equip Status (Work Queue Add)
- (Carrier ID = aaa)
- Stk2
- Bay-Out

### Supervisor
- AMHS Equip Status
- Carrier Location
- AMHS Equip Cap.
- AMHS Equip Status

### Integrator
- **T17. AMHS Equip Monitoring**
- **T18. Carrier Tracking**
- **T19. Update Stocker Capacity**
- **T20. Update AMHS Equip Status**
- **T21. AMHS Equip Interface**
  1. Check Equip Status (Stk2, Ohs1, Stk4), if no good take a branch
  2. Issue Transfer Command

### TSC
- Report Crane State
- Report Carrier State
- Report Comp. Stk2
- AMHS Equip Status (Work Queue Delete)
- AMHS Equip Status (Work Queue Add)

### Equip
- AMHS Equip Status
- Ohs1
- Port Dest = Stk4/Port
<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Integrator</th>
<th>TSC</th>
<th>Equip</th>
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<tr>
<td>Carrier Location</td>
<td>I22. Tr Execution Monitoring</td>
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<td>AMHS Equip Status</td>
<td>I23. AMHS Equip Monitoring</td>
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<tr>
<td>AMHS Equip Status</td>
<td>I24. Carrier Tracking</td>
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<tr>
<td>AMHS Equip Status</td>
<td>I25. Update AMHS Equip Status</td>
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<td>AMHS Equip Status</td>
<td>I26. AMHS Equip Interface</td>
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<td></td>
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</table>

**T14** Report Tr Cmd State
**T15** Report Vehicle State
**T16** Report Carrier State
**T17** Report Comp. Ohs1
**T18** Report Tr Cmd State
**T19** Report Crane State
**T20** Report Carrier State
**T21** Report Comp. Stk4

**Stk4** Carrier Location

* (Carrier ID = aaa Bay, In L-P/T = Relay)

---

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Integrator</th>
<th>TSC</th>
<th>Equip</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>AMHS Equip Status</td>
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<tr>
<td>Carrier Location</td>
<td>I27. Tr Execution Monitoring</td>
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<td>I28. AMHS Equip Monitoring</td>
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<tr>
<td>Carrier Location</td>
<td>I29. Carrier Tracking</td>
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<tr>
<td>AMHS Equip Cap.</td>
<td>I30. Update Stocker Capacity</td>
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<tr>
<td>AMHS Equip Status</td>
<td>I31. Update AMHS Equip Status</td>
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</tbody>
</table>

**T18** Report Tr Cmd State
**T19** Report Crane State
**T20** Report Carrier State
**T21** Report Comp. Stk4

**Stk4** Carrier Location

* (Carrier ID = aaa Bay, In L-P/T = Relay)
### Supervisor

<table>
<thead>
<tr>
<th>AMHS Equip Status</th>
<th>I32 AMHS Equip Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1) Check Equip Status(Stk4)</td>
</tr>
<tr>
<td></td>
<td>2) Issue Transfer Command</td>
</tr>
<tr>
<td></td>
<td>(Carrier ID = aaa, Bay-Out)</td>
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</table>

### Integrator

<table>
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<th>I33. Tr Execution Monitoring</th>
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</table>

### TSC

- AMHS Equip Status (Work Queue Add)
- Carrier Transfer
- I33. Tr Execution Monitoring
- Carrier Transfer

### Equip

- AMHS Equip Status
- Carrier Transfer
- I35 Carrier Tracking

---

### Supervisor

<table>
<thead>
<tr>
<th>AMHS Equip Cap.</th>
<th>I36 Update Stocker Capacity</th>
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</thead>
</table>

### Integrator

<table>
<thead>
<tr>
<th>I37 Update AMHS Equip Status</th>
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</thead>
</table>

### TSC

- AMHS Equip Status (Work Queue Delete)
- Carrier Transfer
- I35 Carrier Tracking

### Equip

- AMHS Equip Status
- Carrier Transfer
- I35 Carrier Tracking
### Supervisor

| AMHS Equip Status |

### Integrator

<table>
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<th>140. AMHS Equip Monitoring</th>
<th>T27. Report Vehicle State</th>
</tr>
</thead>
<tbody>
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<td>AMHS Equip Status</td>
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<tr>
<td>AMHS Equip Status</td>
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<tr>
<td>142. Carrier Tracking</td>
<td>T29. Report Carrier State</td>
</tr>
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<td>Carrier Location</td>
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<td>143. Update AMHS Equip Status</td>
<td>AMHS Equip Status (Work Queue Delete)</td>
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<tr>
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<tr>
<td>144. AMHS Equip Interface</td>
<td>T30. Report Comp. Ohs2</td>
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<tr>
<td>1) Check Equip Status(Stk7)</td>
<td>Stk7 (Detail See SEM)</td>
</tr>
<tr>
<td>2) Issue Transfer Command</td>
<td>AMHS Equip Status (Work Queue Add)</td>
</tr>
<tr>
<td>AMHS Equip Status</td>
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</tr>
<tr>
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<td>145. Tr Execution Monitoring</td>
<td>T31. Report Tr Cmd State</td>
</tr>
<tr>
<td>Carrier Transfer</td>
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<tr>
<td>146. AMHS Equip Monitoring</td>
<td>T32. Report Crane State</td>
</tr>
<tr>
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</tr>
<tr>
<td>147. Carrier Tracking</td>
<td>T33. Report Carrier State</td>
</tr>
<tr>
<td>Carrier Location</td>
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<tr>
<td>148. Update Stocker Capacity</td>
<td>T34. Report Comp. Stk7</td>
</tr>
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<tr>
<td>149. Update AMHS Equip Status</td>
<td>AMHS Equip Status (Work Queue Delete)</td>
</tr>
<tr>
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<td>Supervisor</td>
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</tr>
<tr>
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<tr>
<td>I50 Report Macro Cmd Comp.</td>
<td>/</td>
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<tr>
<td>(Carrier ID = aaa Carrier Location = Stk7)</td>
<td>/</td>
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<tr>
<td>S4. Carrier Dispatch</td>
<td>/</td>
</tr>
<tr>
<td>1) Register Lot in Next Process</td>
<td>/</td>
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<tr>
<td>/ Equip Waiting Queue with Carrier Location</td>
<td>/</td>
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</table>
4.3 Scenario Case 2

**User Requirements Item (Underline)**

<table>
<thead>
<tr>
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<th>TSC</th>
<th>Equip</th>
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<tr>
<td><strong>IN Data</strong></td>
<td><strong>Proc. Equip Status</strong></td>
<td><strong>OUT Data</strong></td>
<td><strong>AMHS Equip Status</strong></td>
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<tr>
<td><strong>S1. Monitor Equip Status</strong></td>
<td><strong>I1. AMHS Equip Monitoring</strong></td>
<td></td>
<td><strong>EI. Report Equip Status</strong></td>
</tr>
<tr>
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<td>AMHS Equip Status</td>
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<td>Eq1</td>
</tr>
<tr>
<td><strong>S2. Carrier Dispatch</strong></td>
<td><strong>E1. Report TSC State</strong></td>
<td></td>
<td><strong>E2. Ready to Load</strong></td>
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<tr>
<td>1) Determine Next Lot/Carrier by Next Process/Equip Waiting Queue (Lot ID = AAA and BBB)</td>
<td>(Port1)</td>
<td>Eq3</td>
<td>Eq3</td>
</tr>
<tr>
<td></td>
<td>(Port2)</td>
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</table>

---

**Supervisor**

2) Issue Macro Command

(Carrier ID = aaa/bbb and Dest = Eq3/Port1 and Port2)

- **Carry Transfer**
- **Carrier Location**
- **Route Map**
- **AMHS Equip Cap.**

**Integrator**

12. AMHS Route Det.

1) Check Carrier Location
2) Select AMHS Route
3) Check 1st Storage Logical Partition(L-P/T) Capacity(for Relay)
4) Reserve 1st Storage L-P/T Capacity (Stk8’s Relay)

**TSC**

**Equip**

13. Carrier T.D.G

1) Divide Transfer Batch

14. AMHS Equip Interface

1) Check Equip Status (Stk7, Ohs2, Stk8), if no good take a branch
2) Issue Transfer Command

---

![Diagram](image-url)
### Supervisor

- AMHS Equip Status
- Carrier Transfer
- AMHS Equip Status

### Integrator

- **I5. AMHS Equip Interface**
  1) Check Equip Status (Stk7)
  2) Issue Transfer Command

- **I6. Tr Execution Monitoring**

- **I7. AMHS Equip Monitoring**

### TSC

- **T2. Report Tr Cmd State**
  - AMHS Equip Status (Work Queue Add)
  - Carrier Transfer
  - Carrier Location

### Equip

- **T1. Report Equip State**
  - Stk7
  - Carrier Transfer
  - AMHS Equip Status
  - Carrier Location

- **T3. Report Crane State**

- **T5. Report Comp. (Work Queue Delete)**

- **T7. AMHS Equip Interface**
  1) Check Equip Status (Stk7, Ohs2, Stk8), if no good take a branch
  2) Issue Transfer Command

- **T8. Carrier Tracking**

- **T9. Update Stocker Capacity**

- **T10. Update AMHS Equip Status**

- **T11. AMHS Equip Interface**

- **T12. Tr Execution Monitoring**

- **T13. Report Crane State**

- **T14. Report Carrier State**

- **T15. Carrier Transfer (Work Queue Add)**

- **T16. Carrier Transfer (Work Queue Delete)**

- **T17. Carrier Transfer (Work Queue Add)**

- **T18. Carrier Transfer (Work Queue Delete)**

---

Technology Transfer # 99073793A-TR

International SEMATECH
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<td>AMHS Equip Cap.</td>
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</table>

1) Collect Transfer Batch
As the Same Operation as Carrier ID = aaa till Reaching Stk8

I24Carrier T.D.G
1) Collect Transfer Batch

I25AMHS Equip Interface
1) Check Equip Status(Stk8, Agt2, Eq3), if no good take a branch
2) Issue Transfer Command

I26AMHS Equip Interface
1) Issue Transfer Command

I27Tr Execution Monitoring

T15Report Tr Cmd State

Carrier Transfer

AMHS Equip Status

Proc. Equip Status

AMHS Equip Status

Carrier Transfer
<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Integrator</th>
<th>TSC</th>
<th>Equip</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

- **Supervisor**
  - AMHS Equip Status
  - Carrier Location
  - AMHS Equip Cap.
  - AMHS Equip Status

- **Integrator**
  - AMHS Equip Monitoring
  - Carrier Tracking
  - Update Stocker Capacity
  - Update AMHS Equip Status

- **TSC**
  - Report Crane State
  - Report Carrier State
  - AMHS Equip Cap.
  - AMHS Equip Status

- **Equip**
  - (Carrier ID = aaa/bbb Stock-Out)
  - (Work Queue Delete)

---

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Integrator</th>
<th>TSC</th>
<th>Equip</th>
</tr>
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<tbody>
<tr>
<td></td>
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</tbody>
</table>

- **Supervisor**
  - Equip Status
  - AMHS Equip Status

- **Integrator**
  - AMHS Equip Interface
    1) Check Equip Status (Stk8, Agt2, Equip3), if no good take a branch
    2) Issue Transfer Command
      (Carrier ID = aaa/bbb Src = Stk8/Port Dest = Eq3/Port1 and Port2)

- **TSC**
  - Report Tr Cmd State
  - Agt2

- **Equip**
  - AMHS Equip Status
    (Work Queue Add)

---

- **T20** Report Vehicle State
- **I34** AMHS Equip Monitoring
- **AMHS Equip Status**
<table>
<thead>
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<tr>
<td>Carrier Location</td>
<td><strong>I35</strong> Carrier Tracking</td>
<td><strong>T21</strong> Report Carrier State</td>
<td>Carrier Location</td>
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<tr>
<td>AMHS Equip Status</td>
<td><strong>I36</strong> Update AMHS Equip Status</td>
<td><strong>T22</strong> Report Comp. Agt2</td>
<td>AMHS Equip Status (Work Queue Delete)</td>
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<td>(Carrier ID = aaa/bbb Carrier Location = Eq3/Port1 and Port2)</td>
<td><strong>T37</strong> Report Macro Cmd Comp</td>
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<td>(Carrier ID = aaa Carrier Location = Eq3/Port1)</td>
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<td>(Carrier ID = bbb Carrier Location = Eq3/Port2)</td>
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<td>S3. Check Lot Process Progress</td>
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<td>S4. Issue Process/Equip Command</td>
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<td>(Lot ID = AAA)</td>
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<td>(Lot ID = BBB)</td>
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</table>
4.4 Scenario Case 3

**User Requirements Item (Underline)**

**IN Data**

- **S1.** Monitor Equip Status

**OUT Data**

- **T1.** Report TSC State
- **E1.** Report Equip Status

**TSC**

- **Proc. Equip Status**
- **AMHS Equip Status**

**Equip**

- **AMHS Equip Status**

**Supervisor**

- **Monitor Equip Status**
- **AMHS Equip Cap.**
- **AMHS Equip Status**

**Integrator**

- **AMHS Equip Monitoring**
- **Proc. Equip Status**
- **AMHS Equip Status**

**Carrier Transfer**

- **Carrier Location**
- **Route Map**
- **AMHS Equip Cap.**
- **AMHS Equip Status**

**I2.** AMHS Route Det./Advanced

- 1) Select AMHS Route
- 2) Check 1st Storage Logical Partition (L-P/T) Capacity (for Stock-In) and Select 1st Storage
- 3) Check TSCs' Statuses till 1st Storage (Agt1 and Stk2)
- 4) Reserve 1st Storage L-P/T Capacity (Stk2's Stock-In)

**I3.** AMHS Equip Interface

- 1) Check Equip Status (Eq1, Agt1, Stk2). If no good take a branch
- 2) Issue Transfer Command

**I4.** AMHS Equip Interface (Work Queue Add)

**Carrier Location**

- **Route Map**
- **AMHS Equip Cap.**
- **AMHS Equip Status**

**Proc. Equip Status**

- **AMHS Equip Status**

**E2.** Ready to Unload Eq1

**S2.** Determine Next Process/Equip (Lot ID = AAA Port No.)

**S3.** Destination Dispatch

1) Determine Destination (Stk7)
2) Issue Macro Command

(Carrier ID = aaa Carrier Usage = Etch1 Src = Eq1/Port Dest = Stk7)
### Supervisor
- AMHS Equip Status
- AMHS Equip Status
- AMHS Equip Cap.

### Integrator
- Update AMHS Equip Status (Work Queue Delete)
- AMHS Equip Status
  - I4. Update AMHS Equip Status
  - I5. AMHS Equip Interface
    1) Check Equip Status (Stk2)
    2) Issue Transfer Command
  - AMHS Equip Cap.
  - AMHS Equip Status
    - T4. Report Comp. Stk2
    - T3. Report Carrier State

### TSC
- Update AMHS Equip Status
- AMHS Equip Status
  - T2. Report Comp. Agt1
  - AMHS Equip Status
    - Work Queue Add
    - Work Queue Delete

### Equip
- Stk2 (Detail See SEM)
- Stock-In L-P/T = Stock-In

---

### Supervisor
- Carrier Transfer
- Carrier Location
- Route Map
- AMHS Equip Cap.
- AMHS Equip Status

### Integrator
- AMHS Route Det./Advanced and Stocker Overflow Control
  - 1) Select AMHS Route
  - 2) Check 2nd and 3rd Storage L-P/T Capacity (2nd Storage for Relay and 3rd Storage for Etch1, Stk4 is Down so 2nd Storage = Stk5/Stk7’s Etch1 is Full so Temp. 3rd Storage = Stk8) and Select them
  - 3) Check TSC’s Statuses till 3rd Storage (Stk2, Ohs1, Stk4, Ohs2, and Stk7)
  - 4) Reserve 2nd and 3rd Storage L-P/T Capacity (Stk4’s Relay and Stk7’s Temp.)

### TSC
- AMHS Equip Cap.
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<tr>
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<th>TSC</th>
<th>Equip</th>
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</table>
| AMHS Equip Status | I9. AMHS Equip Interface  
1) Check Equip Status (Stk2)  
2) Issue Transfer Command  
(Carrier ID = aaa) | Stk2 (Bay-Out) | AMHS Equip Status (Work Queue Add) |
| AMHS Equip Status | I11. Update AMHS Equip Status | Stk2 Report Carrier State | |
| AMHS Equip Status | I12. AMHS Equip Interface  
1) Check Equip Status (Stk2, Ohs1, Stk5), if no good take a branch  
2) Issue Transfer Command | AMHS Equip Status (Work Queue Delete) | |
| AMHS Equip Status | | | |
| AMHS Equip Cap. | | | |

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<tr>
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<td>I13. Update AMHS Equip Status</td>
<td>Ohs1 Report Comp.</td>
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</table>
| AMHS Equip Status | I14. AMHS Equip Interface  
1) Check Equip Status (Stk5)  
2) Issue Transfer Command  
(Carrier ID = aaa) | Stk5 (Detail See SEM) | AMHS Equip Status (Work Queue Add) |
### Supervisor

- AMHS Equip Status
- Carrier Transfer
- Carrier Location
- Route Map
- AMHS Equip Cap.
- AMHS Equip Status

### Integrator

1. **T9** Update AMHS Equip Status
2. **I16** Update AMHS Equip Status
3. **I17** AMHS Route Det./Advanced and Stocker Overflow Control
   - 1) Check 3rd Storage L-P/T Capacity and Select it (Stk7’s Etch1 is Full so Temp. 3rd Storage = Stk8)
   - 2) Check TSC’s Statuses till 3rd Storage (Stk5, Ohs2, and Stk8)
   - 3) If TSC’s Statuses are Changed, Determine AMHS Route Again
4. **I18** AMHS Equip Interface
   - 1) Check Equip Status (Stk5)
   - 2) Issue Transfer Command

### TSC

- AMHS Equip Status
- (Work Queue Delete)

### Equip

- AMHS Equip Status
- (Work Queue Add)

---

### Supervisor

- AMHS Equip Cap.
- AMHS Equip Status
- AMHS Equip Status

### Integrator

1. **T10** Update Stocker Capacity
   - (Carrier ID = aaa Bay-Out)
2. **I19** Update Stocker Capacity
3. **I20** Update AMHS Equip Status
4. **I21** AMHS Equip Interface
   - 1) Check Equip Status (Stk5, Ohs2, Stk8)
   - 2) Issue Transfer Command
   - (Carrier ID = aaa Src = Stk5/Port Dest = Stk8/Port)

### TSC

- AMHS Equip Status
- (Work Queue Delete)
- AMHS Equip Status
- (Work Queue Add)

- AMHS Equip Cap.
- Ohs2

### Equip

- AMHS Equip Status
- Ohs2
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<td><strong>T14</strong> Update Stocker Capacity</td>
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<td><strong>T15</strong> Stocker Overflow Control (Carrier ID = aaa Carrier Location = Stk8)</td>
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<td><strong>T16</strong> Stocker Overflow Control (No Change Continue)</td>
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<td><strong>T17</strong> Update Stocker Capacity</td>
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</table>

**S4** Destination Dispatch

1) Check Destination(Stk7)
2) Inform to Continue or Modify Original Macro Command

(No Change Continue)
### Supervisor

#### I28 Stocker Overflow Control
1) Inquire New Macro Command and Wait for Replay

- Stocker = Stk7
- L-P/T = Etch1
- Open Space = 1 Carrier

#### S5 Carrier Dispatch
1) Check WIP Data (No Carrier)
2) Inform New Macro Command Existence or not (No)

#### I29 Stocker Overflow Control
1) Assign Carrier to Storage Open L-P/T Capacity (Stk7’s Etch1/Carrier ID = aaa)

### Integrator

#### Equip

1) Select AMHS Route
2) Check TSC’s Statuses till 3rd Storage (Stk8, Ohs2, and Stk7)

### TSC

### Equip

### Supervisor

#### I30 AMHS Route Det./Advanced
1) Assign Carrier to Storage Open L-P/T Capacity (Stk7’s Etch1/Carrier ID = aaa)

#### I31 AMHS Equip Interface
1) Check Equip Status (Stk8)
2) Issue Transfer Command

#### I32 Update Stocker Capacity
3) Reserve 3rd Storage L-P/T Capacity (Stk7’s Etch1)

#### I33 Update AMHS Equip Status

#### AMHS Equip Cap.

#### AMHS Equip Status

#### AMHS Equip Cap.

### Integrator

#### T16 Report Carrier State

#### T17 Report Comp. Stk8
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<td>AMHS Equip Status&lt;br&gt;(Work Queue Add)</td>
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<td>AMHS Equip Status&lt;br&gt;(Work Queue Add)</td>
<td>Stk7 (Detail See SEM)</td>
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<tr>
<td>AMHS Equip Status</td>
<td><strong>I36. AMHS Equip Interface</strong>&lt;br&gt;1) Check Equip Status (Stk7)&lt;br&gt;2) Issue Transfer Command</td>
<td>AMHS Equip Status&lt;br&gt;(Work Queue Add)</td>
<td>AMHS Equip Status&lt;br&gt;(Work Queue Delete)</td>
</tr>
<tr>
<td></td>
<td><strong>I38. Update AMHS Equip Status</strong></td>
<td><strong>I39. Report Macro Cmd Comp.</strong>&lt;br&gt;(Carrier ID = aaa Carrier Location = Stk7)</td>
<td>AMHS Equip Status&lt;br&gt;(Work Queue Delete)</td>
</tr>
<tr>
<td>S6 Carrier Dispatch</td>
<td>1) Register Lot in Next Process&lt;br&gt;/ Equip Waiting Queue with&lt;br&gt;Carrier Location</td>
<td><strong>T19. Report Carrier State</strong>&lt;br&gt;<strong>T20. Report Comp.&lt;br&gt;Stk8</strong></td>
<td><strong>T18. Report Comp.&lt;br&gt;Ohs2</strong></td>
</tr>
</tbody>
</table>

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### 4.5 Scenario Case 4

#### User Requirements Item (Underline)

<table>
<thead>
<tr>
<th>Supervisor</th>
<th>Integrator</th>
<th>TSC</th>
<th>Equip</th>
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<tbody>
<tr>
<td>AMHS Equip Status</td>
<td>AMHS Equip Monitoring</td>
<td>Carrier Location</td>
<td>AMHS Equip Cap.</td>
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<td>IN Data</td>
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<tr>
<td>AMHS Equip Status</td>
<td>AMHS Equip Status</td>
<td>Carrier Location (Stk6/Port)</td>
<td>AMHS Equip Status</td>
</tr>
<tr>
<td>AMHS Equip Cap.</td>
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<td>AMHS Equip Cap.</td>
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<td>AMHS Equip Status</td>
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#### OUT Data

<table>
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<tr>
<td>AMHS Equip Cap.</td>
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<td>Carrier ID Report Stk6</td>
<td>AMHS Equip Status</td>
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<td>AMHS Equip Status</td>
<td>AMHS Equip Cap.</td>
<td>Carrier ID Report Stk6</td>
<td>AMHS Equip Status</td>
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<tr>
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<td>Carrier Location (Stk6/Port)</td>
<td>AMHS Equip Status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carrier Location</td>
<td>AMHS Equip Status</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AMHS Equip Status (Work Queue Delete)</td>
</tr>
</tbody>
</table>

#### IN Data

- **I1. AMHS Equip Monitoring**
  - Report TSC State
- **I2. Manual Carrier Input**
  - Update Carrier Location
  - Check Storage Status (Stk6)
  - Check Storage L-P/T Capacity (for Stock-In) and Reserve it (Stk6’s Stock-In)
- **I3. AMHS Equip Interface**
  - Issue Transfer Command

#### OUT Data

- **T1. Report TSC State**
- **T2. Carrier ID Report Stk6**
- **T3. Report Carrier State**
- **T4. Report Comp. Stk6**
- **T5. Carrier ID Report**

---

**S1. Determine Next Process/Equip**

**S2. Destination Dispatch**

1) Determine Destination (Stk4)
2) Issue Macro Command

(Carrier ID = aaa Carrier Usage = Wet1 Src = Eq1/Port Dest = Stk4)
### Supervisor
- Carrier Transfer
- Carrier Location
- Route Map
- AMHS Equip Cap.
- AMHS Equip Status

### Integrator
1. Select AMHS Route
2. Check 1st Storage Logical Partition (L-P/T) Capacity (for Wet1) and Select 1st Storage
3. Check TSC's Statuses till 1st Storage (Stk6, Ohs1, Ohs2 and Stk4)
4. Check TSC's Carrier Traffic (Ohs1 Work Queue is Full so Ohs2 is Selected)
5. Reserve 1st Storage L-P/T Capacity (Stk4's Wet1)

### TSC
- AMHS Equip Cap.

### Equip
(I) AMHS Route Det./Advanced
1) Check Equip Status (Stk6)
2) Issue Transfer Command

---

### Supervisor
- AMHS Equip Cap.
- AMHS Equip Status

### Integrator
1. Update Stocker Capacity
2. Update AMHS Equip Status
3. AMHS Equip Interface
1) Check Equip Status (Stk6, Ohs2, Stk4), if not good take a branch
2) Issue Transfer Command
3. Update AMHS Equip Status

### TSC
- AMHS Equip Status
- AMHS Equip Status
- AMHS Equip Status

### Equip
- AMHS Equip Status
- AMHS Equip Status

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<tr>
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<td>AMHS Equip Status</td>
<td>AMHS Equip Status (Work Queue Delete)</td>
<td>AMHS Equip Status (Work Queue Add)</td>
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<td>AMHS Equip Status</td>
<td>113 AMHS Equip Interface</td>
<td>Stk4 (Detail See SEM)</td>
<td>Stk4</td>
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<tr>
<td>AMHS Equip Cap.</td>
<td>1) Check Equip Status (Stk4)</td>
<td>(Carrier ID = aaa Bay-In L-P/T = Wet1)</td>
<td>Report Carrier State</td>
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<tr>
<td>AMHS Equip Status</td>
<td>2) Issue Transfer Command</td>
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<td>114 Update Stocker Capacity</td>
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<td>AMHS Equip Cap.</td>
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<td>T8 Report Comp.</td>
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<td>115 Update AMHS Equip Status</td>
<td>T9 Report</td>
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<td>116 Report Macro Cmd Comp.</td>
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<td>(Carrier ID = aaa Carrier Location = Stk4)</td>
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<td>S3 Carrier Dispatch</td>
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<tr>
<td>1) Register Lot in Next Process</td>
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<tr>
<td>/ Equip Waiting Queue with Carrier Location</td>
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