檔案名稱	Mirle WCS-ShuttleC Communication Protocol	發行時間	2020/03
專案/工令		發行版次	1.0

Mirle WCS with ShuttleC Communication Protocol

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Revision History

Date	Reason/History	Revision	By whom	Signature
2020/03/04	Create	1.0	Allen Liu	
2020/03/18	1. Shuttle Status Report 只回報 4 種主要狀態 閒置/忙錄/充電/異常			
	2.考慮刪除 P13,S14,P25,S26,P35,S36,P55,S56			
	3.新增 Shelf 相關 P71,S72,P73,S74			
	4.P41,P51,P61 增加 CST_ID (20 Bytes)			
	5.修改 Scenario Normal Transfer			
	6.新增 Scenario-Double Storage, Empty Retrieval	1.0.1	Leon Hsu	
2020/3/20	Allen & 志明 討論後更新	1.0.2	Allen Liu	
2020/07/10	1.修改 P61 的回報任務失敗 Result Code	1.0.3	Allen Liu	
	2.新增 ShuttleC 維修區 Block Report 的 Event: P71,S71,P73,S74			
2020/07/23	1. 修正 Normal Transfer Scenario 2. 修正 Double Storage Scenario 3. 修正 Empty Retrieval Scenario 4. 將所有 Message 中的 VehicleNo 修正為 4 碼	1.0.4	Stanley Yeh	
2020/08/04	1.新增 Message P81& S82	1.0.5	Stanley Yeh	
2021/01/13	1. 新增 Message P75 & S76 2. 新增 Message P83 & S84 3. 新增 Message P85 & S86 4. 修改 ChangeLayer Scenario	1.0.6	Stanley Yeh	
2021/05/06	5. 1. 新增 Message P95 & S94	1.0.7	Stanley Yeh	
2021/08/25	1. 新增 Message P89 & S90 2. 修改 Message P91 & S92 3. 修改 Message P85 4. 修改 ChangeLayer Scenario	1.0.9	Stanley Yeh	

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2021/08/30	1. 新增 Message P67 & S68 2. 新增 Message P69 & S70 3. 修正 Change Layer Scenario 4. 新增 Cancel Change Layer Scenario 5. 新增 Vehicle Info Report Scenario	1.1.0	Stanley Yeh
2021/10/21	1. 更新目錄 2. 修正 Message Detail 中總字數不符問題	1.1.1	Stanley Yeh

1. 目的 Purpose：

定義 TCP/IP上訊息傳遞的通訊控制介面。

2. 適用範圍 Scope：

這份規格文件是針對盟立內部或與供應商之間，關於系統間透過TCP/IP傳遞訊息的通訊控制規範，適用範圍涵蓋：WCS與各子系統設備、單機或複合型式的主製程設備、檢測設備(測試設備)、小型工具機及傳送設備等不同控制軟體間的通訊使用。

3. 名詞定義 Terms Definition：

無

4. 作業流程與內容 Procedure & Subject Matter：

Notice:

1. 此規範不是最終版本，可依機台特性修改。
   This specification is not the final version and can be modified depend on the equipment characteristic.

1. 目錄

1. Introduction

PS Protocol is a simple protocol using at communication via TCP/IP. It's similar to HSMS + SECS II standard but easy to implement. It directly uses string transferring to byte array than send out to the other side.

2. Connection Mode

Active Side: TCP Client

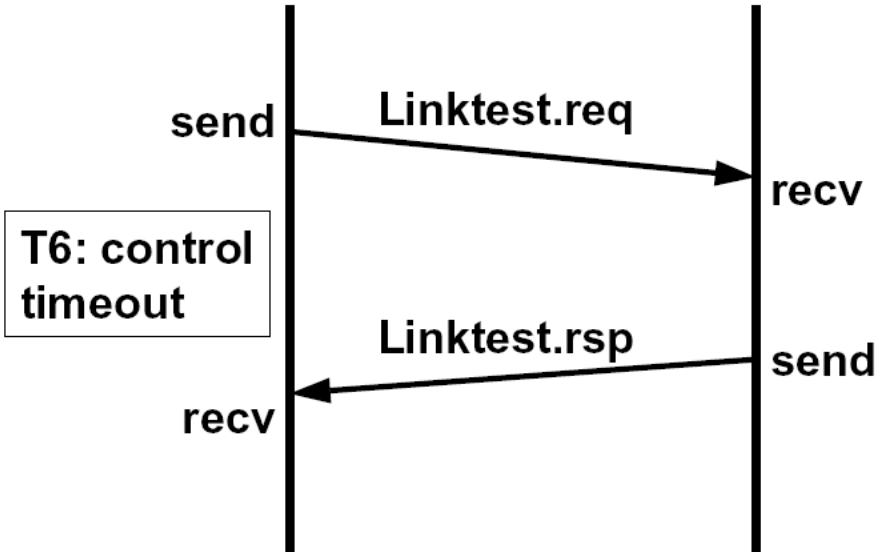
Passive side: TCP Server

3. Link Test Message

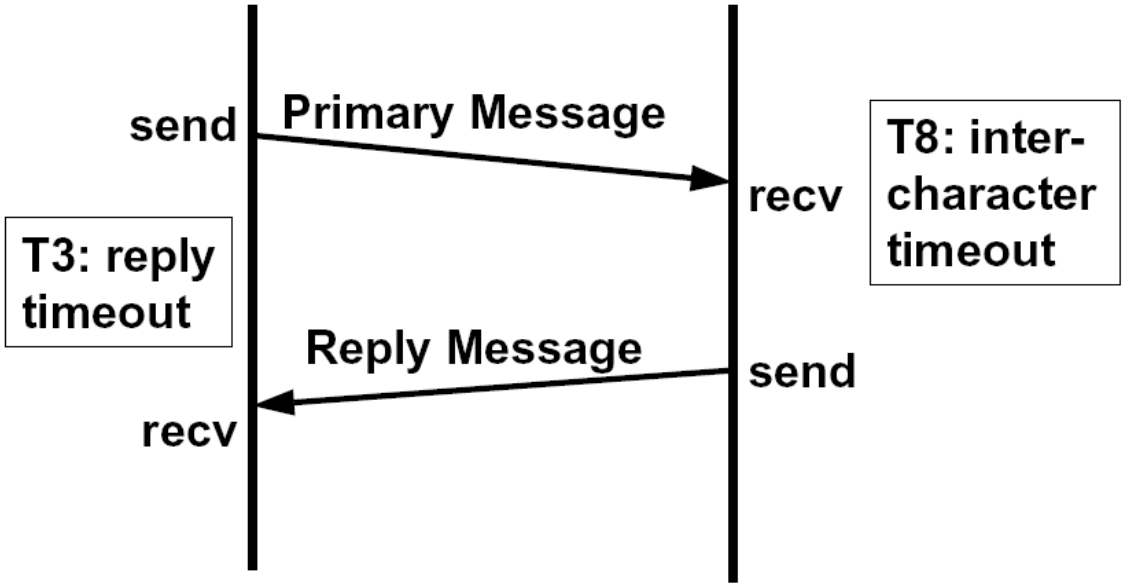
P00: Link Test Request

S00: Link Test Reply

Both Active/Passive side can send P00 to the other side and receiver must reply S00 immediately. The side who send P00 need to check T6 timeout.



4. Procedures of Data transaction



5. Message Format

The message format composes **message length**, **header**, **data** and **checksum**. Size of message **length** is **1** byte, **header** is **3** bytes, **system bytes** are **4** bytes, and **data** is **other** bytes.

Block — header plus up to 125 bytes of data.

Message Lengths — The unsigned integer value of the first byte sent after receipt of EOT is the length of the block being sent. The length includes the bytes sent after the length byte, excluding the 2 bytes of the checksum. The **maximum block length** allowed by message is **224** bytes, and the **minimum** is **3** bytes.

System Bytes — The system bytes is unique. The system bytes of secondary message is copy from primary message.

Header —The operation of all communication functions above the message transfer protocol is linked to information contained in a 3-byte data element called the header. The header is always the first 3 bytes of every block sent by the message transfer protocol.

Primary Message (hereinafter called as "P")— A primary message is defined as any odd numbered message.

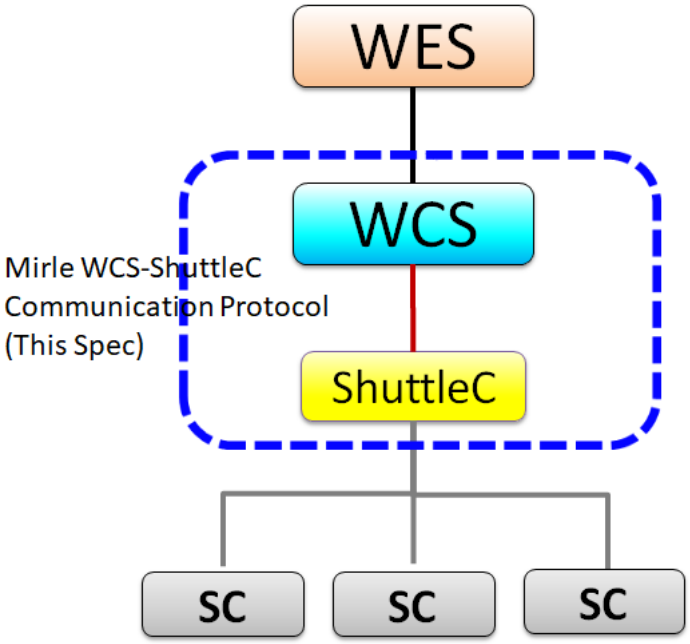
Secondary Message (hereinafter called as "S") — A secondary message is defined as any even numbered message.

The header and data information type is character of ASCII, message length and system bytes are Hex of ASCII (see Figure 4).

Reply Timeout, T3 — The reply timeout, T3, limits the time between sending primary message and receiving secondary message.

Link Test Reply Timeout, T6 — The link test reply timeout, T6, limits the time between sending P00 and receiving S00.

6. System Structure



System Structure Diagram

7. Sample Message

Primary Message Sample

P21 3090

Message lengths	7	6	5	4	3	2	1	0
04	0	0	0	0	0	1	0	0
Header								
P	0	1	0	1	0	0	0	0
2	0	0	1	1	0	0	1	0
1	0	0	1	1	0	0	0	1
Data								
3	0	0	1	1	0	0	1	1
0	0	0	1	1	0	0	0	0
9	0	0	1	1	1	0	0	1
0	0	0	1	1	0	0	0	0
System Bytes								
02	0	0	0	0	0	0	1	0
02	0	0	0	0	0	0	1	0
02	0	0	0	0	0	0	1	0
17	0	0	0	1	0	0	0	1

Secondary Message Sample

S22 (Header Only)

Message lengths	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	0
Header								
S	0	1	0	1	0	0	1	1
2	0	0	1	1	0	1	0	0
2	0	0	1	1	0	1	0	0
Data								
System Bytes								
02	0	0	0	0	0	0	1	0

02	0	0	0	0	0	0	1	0
02	0	0	0	0	0	0	1	0
17	0	0	0	1	0	0	0	1

Primary Message Sample

P41 0016A002001

Message lengths	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
11	0	0	0	0	1	1	1	0

Header

P	0	1	0	1	0	0	0	0
4	0	0	1	1	0	1	0	0
1	0	0	1	1	0	0	0	1

Data

0	0	0	1	1	0	0	0	0
0	0	0	1	1	0	0	0	0
1	0	0	1	1	0	0	0	1
6	0	0	1	1	0	1	1	0
A	0	1	0	0	0	0	0	1
0	0	0	1	1	0	0	0	0
0	0	0	1	1	0	0	0	0
2	0	0	1	1	0	0	1	0
0	0	0	1	1	0	0	0	0
0	0	0	1	1	0	0	0	0
1	0	0	1	1	0	0	0	1

System Bytes

02	0	0	0	0	0	0	1	0
02	0	0	0	0	0	0	1	0
02	0	0	0	0	0	0	1	0
18	0	0	0	1	0	0	1	0

Secondary Message Sample

S22 00160

Message lengths	7	6	5	4	3	2	1	0
05	0	0	0	0	0	1	1	0
Header								
S	0	1	0	1	0	0	1	1
4	0	0	1	1	0	1	0	0
2	0	0	1	1	0	0	1	0
Data								
0	0	0	1	1	0	0	0	0
0	0	0	1	1	0	0	0	0
1	0	0	1	1	0	0	0	1
6	0	0	1	1	0	1	1	0
0	0	0	1	1	0	0	0	0
System Bytes								
02	0	0	0	0	0	0	1	0
02	0	0	0	0	0	0	1	0
02	0	0	0	0	0	0	1	0
18	0	0	0	1	0	0	1	0

8. Message List

Wcs: Host (WCS)

Shc: ShuttleC

Link 1: Command/Query Request

Link 2: Data Report

Message Classification	Message ID	Message Direction	Link	Description
ON-Line/ OFF-Line Request	P11	wcs ← Shc	2	ShuttleC Online
	S12	wcs → Shc	2	ShuttleC Online Acknowledge
	P13	wcs ← Shc	2	ShuttleC Offline
	S14	wcs → Shc	2	ShuttleC Offline Acknowledge
	P15	wcs → Shc	1	Date and Time Setting
	S16	wcs ← Shc	1	Date and Time Setting Acknowledge
Command Request	P41	wcs → Shc	1	Command Request
	S42	wcs ← Shc	1	Command Request Acknowledge
	P43	wcs → Shc	1	Command Cancel
	S44	wcs ← Shc	1	Command Cancel Acknowledge
Alarm Set and Reset Request	P51	wcs ← Shc	2	Alarm Report
	S52	wcs → Shc	2	Alarm Report Acknowledge
	P53	wcs → Shc	1	Reset All Alarm Request
	S54	wcs ← Shc	1	Reset All Alarm Request Acknowledge
Command Status Report/Query	P61	wcs ← Shc	2	Command Status Report
	S62	wcs → Shc	2	Command Status Report Acknowledge
	P63	wcs → Shc	1	Query Command Status
	S64	wcs ← Shc	1	Query Command Status Acknowledge
	P65	wcs → Shc	1	Query All Command Status
	S66	wcs ← Shc	1	Query All Command Status Acknowledge
Vehicle Status Report/Query	P67	wcs → Shc	2	Vehicle Status Report
	S68	wcs → Shc	2	Vehicle Status Report Acknowledge
	P69	wcs → Shc	1	Query Vehicle Status
	S70	wcs → Shc	1	Query Vehicle Status Ack
Block Area	P71	wcs ← Shc	2	Block Area Report
	S72	wcs → Shc	2	Block Area Report Acknowledge

Report	P73	wcs ➔ Shc	1	Query All Block Area
	S74	wcs ➔ Shc	1	Query All Block Area Acknowledge
Separate Area Count Report	P75	wcs ➔ Shc	1	Separate Area Count Report
	S76	wcs ➔ Shc	1	Separate Area Count Response
Unknow Cst On Vehicle Report	P81	wcs ➔ Shc	1	Report Unknow Cst On Vehicle
	S82	wcs ➔ Shc	1	Report Unknow Cst On Vehicle Acknowledge
Change Layer Request	P83	Shc ➔ wcs	1	Request Change Layer
	S84	Shc➔ wcs	1	Request Change Layer Acknowledge
Change Layer Status Report	P85	Shc➔ wcs	1	Report Change Layer Status
	S86	Shc ➔ wcs	1	Report Change Layer Status Acknowledge
Cancel Change Layer Request	P89	wcs ➔ Shc	1	Cancel Change Layer Request
	S90	wcs ➔ Shc	1	Cancel Change Layer Response
Lifter Status Report	P91	wcs ➔ Shc	1	Lifter Status Report
	S92	wcs ➔Shc	1	Lifter Status Response
Block Shelf Report	P95	wcs ➔ Shc	1	Block Shelf Report
	S96	wcs ➔ Shc	1	Block Shelf Response

註：因車子資訊及儲位的資料量太大，若有需查詢改由 DB Query, 如 Query Inventory, Query All Vehicles

9. Message Detail

P00	Contents: Link Test Request	Direction
	Structure：Header only	Wcs ←→ Shc

S00	Contents: Link Test Request Acknowledge	Direction
	Structure：Header only	Wcs ←→ Shc

P11	Contents: ShuttleC Online	Direction
	Structure：Header only	Wcs ← Shc

S12	Contents: ShuttleC Online Acknowledge	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0:OK, 1:NG	Wcs → Shc

P13	Contents: ShuttleC Offline	Direction
	Structure：Header only	Wcs ← Shc

S14	Contents: ShuttleC Offline Acknowledge	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0:OK, 1:NG	Wcs → Shc

P15	Contents: Date and Time Setting	Direction
	Structure：14 Bytes YYYYMMDDHHMMSS	Wcs → Shc

S16	Contents: Date and Time Setting Acknowledge	Direction
	Structure：1 Bytes 0 = Date and Time Setting Accepted **1 = NG**	Wcs ← Shc

	Contents: Command Request	Direction
P41	Structure：48 Bytes 1~4 Byte = Command Id (0001~9999 cycle) 5 Byte = Command Type A: FromTo (Move+Pick+Move+Deposit) T: To (Move+Deposit) => 用在 2 重格，重新指派卸貨儲位 6 Byte = Priority (1~9) 7~15 Byte = From/Move Shelf No. (001001001~999999999) 16~24 Byte = To Shelf No. (001001001~999999999) 25~44 Byte = CST_ID (預留 20 碼) 45~48 Byte = Vehicle No. (0000-9999), 0000 means no vehicle(最高位為預留) e.g. Command Id = 0016, Priority 9, From shelf no **01001001** to **01001010**,VehicleID=0001,CST_ID:CST0000001 ➔ **0016A90100100101001010CST00000000000000000010001**	Wcs ➔ Shc

S42	Contents: Command Request Acknowledge	Direction
	Structure：5 Byte 1~4 Byte = Command Id (0001~9999, follow P41) 5 Byte = Return Code (0~9, A~Z) 0: OK 1: Other Reason Cannot Execute Command 6. ShuttleC State is not OK 7. Too much command in ShuttleC … e.g. Command Id = 0016, Priority 9, From shelf no **01001001** to **01001010**, CST_ID:CST0000001 OK: **00160** e.g. Command Id = 0016, Priority 9, From shelf no **01001001** to **01001010**, CST_ID:CST0000001 NG: **00166**	Wcs ➔ Shc

P43	Contents: Command Cancel	Direction
	Structure：4 Bytes **1~4 Byte = Command Id (0000~9999)**	Wcs ➔ Shc

S44	Contents: Command Cancel Acknowledge	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG	Wcs ➔ Shc

P51	Contents: Alarm Report	Direction
	Structure：31 Bytes 1~4 Byte = Vehicle No. (0000-9999), 0000 means ShuttleC level alarm. 5 Byte = 0:Reset, 1:Set 6~11 Byte = Error Code 12~31 Byte = CST_ID (預留 20 碼)	Wcs ➔ Shc

S52	Contents: Alarm Report Acknowledge	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG	Wcs ➔ Shc

P53	Contents: Reset All Alarm Request	Direction
	Structure：Header only	Wcs ➔ Shc

S54	Contents: Reset All Alarm Request Acknowledge	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG	Wcs ➔ Shc

	Contents: Command Status Report	Direction
P61	Structure：18 Bytes 1~4 Byte = Command Id (0001~9999 cycle) 5~8 Byte = Vehicle No. (0000-9999), 0000 means no vehicle. 9~14 Byte = Command Status QUEUED: Command Received CSTART: Command Start FCOMPT: From Complete (Move+Pick) TCOMPT: To Complete (Move+Deposit) COFAIL: Command Fail CANCEL: Command Canceled 15~18 Byte = Result Code (0000~9999) 0000: Success Fail Result Code: 0001:Double Storage. 0002:Empty Retrieval. 0003:Path Error 0050: SC broken down on source. It has empty. 0051: SC broken down on halfway. It has empty. 0052: SC broken down on destination. It has empty. 0100: SC broken down on source. It loaded box. 0101: SC broken down on halfway. It loaded box. 0102: SC broken down on destination. It loaded box. 0200: Shelf Error. e.g. Command Id = 0016, current state: From Complete: **00160001FCOMPT**	Wcs ← Shc

S62	Contents: Command Status Report Acknowledge	Direction

	Structure：11Byte 1 Byte = Acknowledge, 0: OK, 1:NG 2~5 Bytes=Command Id(0000~9999) 6~11 Bytes=Command Status QUEUED: Command Received CSTART: Command Start FCOMPT: From Complete (Move+Pick) TCOMPT: To Complete (Move+Deposit) COFAIL: Command Fail CANCEL: Command Canceled	Wcs ➔ Shc

P63	Contents: Query Command Status	Direction
	Structure：4 Bytes 1~4 Byte = Command Id (0000~9999)	Wcs ➔ Shc

S64	Contents: Query Command Status Acknowledge	Direction
	Structure：14 Bytes 1~4 Byte = Command Id (0001~9999 cycle) 5~8 Byte = Vehicle No. (0000-9999), 0000 means no vehicle. 9~14 Byte = Command Status QUEUED: Command Received CSTART: Command Start FCOMPT: From Complete (Move+Pick) TCOMPT: To Complete (Move+Deposit) ~~MCOMPT: Move Complete (Move)~~ COFAIL: Command Fail CANCEL: Command Canceled ~~PAUSED: Command Paused~~ e.g. Command Id = 0016, current state: From Complete: **00160001FCOMPT**	Wcs ➔ Shc

P65	Contents: Query All Command Status	Direction
	Structure：Header only	Wcs ➔ Shc

S66	Contents: Query All Command Status Acknowledge	Direction
	Structure：4 Byte 1 Byte = Acknowledge, 0: OK, 1: NG 2~4 Byte = Amount of commands in ShuttleC (001-999) e.g: After Acknowledge, Shc start using P61 to report all of the Command in ShuttleC to Wcs one by one.	Wcs ← Shc

P67	Contents: Vehicle Status Report	Direction
	Structure：7 Bytes 1~4 Bytes = Vehicle No. (0001-9999) 5~6 Bytes = Vehicle Located Layer (01-99) 7 Byte = Vehicle Status R=Run D=Down I=Idle	Wcs ←Shc

S68	Contents: Vehicle Status Response	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG	Wcs ➔ Shc

P69	Contents: Query Vehicle Status	Direction
	Structure：4 Byte 1~4 Bytes = 1~4 Bytes = Vehicle No. (0000-9999),0000 Means All Vehicle.	Wcs ➔ Shc

S70	Contents: Query Vehicle Status Acknowledge	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG	Wcs ← Shc

P71	Contents: Block Area Report	Direction
	Structure：3 Bytes 1~2 Byte = Area Id (XX) 3 Byte = Block Status (B:block, R:release) e.g. Area Id = A1, current state: Block: A1B	Wcs ← Shc

S72	Contents: Block Area Report Acknowledge	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1:NG	Wcs → Shc

P73	Contents: Query All Block Area	Direction
	Structure：Header only	Wcs → Shc

S74	Contents: Query All Block Area Acknowledge	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG e.g: After Acknowledge, Shc start using P71 to report all of the Block Area in ShuttleC to Wcs one by one.	Wcs ← Shc

P75	Contents: Separate Area Count Report	Direction
	Structure：11 Bytes 1 ~2 Bytes = Layer, (01~99) 3~4 Bytes = Separate Area Count (01-99) 5~11 Bytes=Lifter Service Status,1 Means in Service,0 Means out of service Example:1110000 Means Lifter No.1 To No.3 Are In Service and No.4 To No.7 Are Out Of Service	Wcs ← Shc

S76	Contents: Separate Area Count Response	Direction

	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG	Shc ← Wcs

P81	Contents: Report Unknow Cst On Vehicle	Direction
	Structure：24 Byte 1~4 Byte = = Vehicle No. (0000-9999), 0000 means no vehicle. 5~24 Byte = CST_ID (預留 20 碼)	Shc →Wcs

S82	Contents: Response Unknow Cst On Vehicle	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG	Shc ← Wcs

P83	Contents: Change Layer Request	Direction
	Structure：4 Bytes 1~2 Bytes = Lifter Id, (00-99) 3~4 Bytes= Destination Layer, (01-99)	Wcs ← Shc

S84	Contents: Change Layer Acknowledge	Direction
	Structure：5 Bytes 1 Byte = Acknowledge, 0: OK, 1: NG 2~5 Bytes=Reason Code, //待 WCS 補充	Wcs ← Shc

P85	Contents: Change Layer Status Report	Direction
	Structure：7 Bytes 1~2 Bytes = Lifter Id, (00-99) 3 Byte = Change Layer Status Q: Command Initial S: Command Processing C: Command Complete F: Command Fail 4~7 Bytes = Result Code (0000~9999) 0000: Success Fail Result Code: //待 WCS 補充	Shc ← Wcs

S86	Contents: Change Layer Status Acknowledge	Direction
	Structure：3 Byte 1~2 Bytes = Lifter Id, (00-99) 3 Byte = Acknowledge, 0: OK, 1: NG	Wcs ← Shc

P89	Contents: Cancel Change Layer Request	Direction
	Structure：8 Bytes 1~4 Bytes = Command ID (0000~9999) 5~8 Bytes = Vehicle ID	Shc ← Wcs

S90	Contents: Cancel Change Layer Response	Direction
	Structure：8 Byte 1 ~4 Bytes = Command ID (0000~9999) 5~8 Byte = Result Code (0000~9999) 0000: Success Fail Result Code: 0001: Shuttle moved in lifter already	Wcs ← Shc

P91	Contents: Lifter Arrival Report	Direction

	Structure：4 Bytes 1 ~2 Bytes = Lifter ID (00~99) 3~4 Bytes = Lifter Location(00~99 Layer)	Shc ← Wcs

S92	Contents: Lifter Arrival Response	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG	Wcs ← Shc

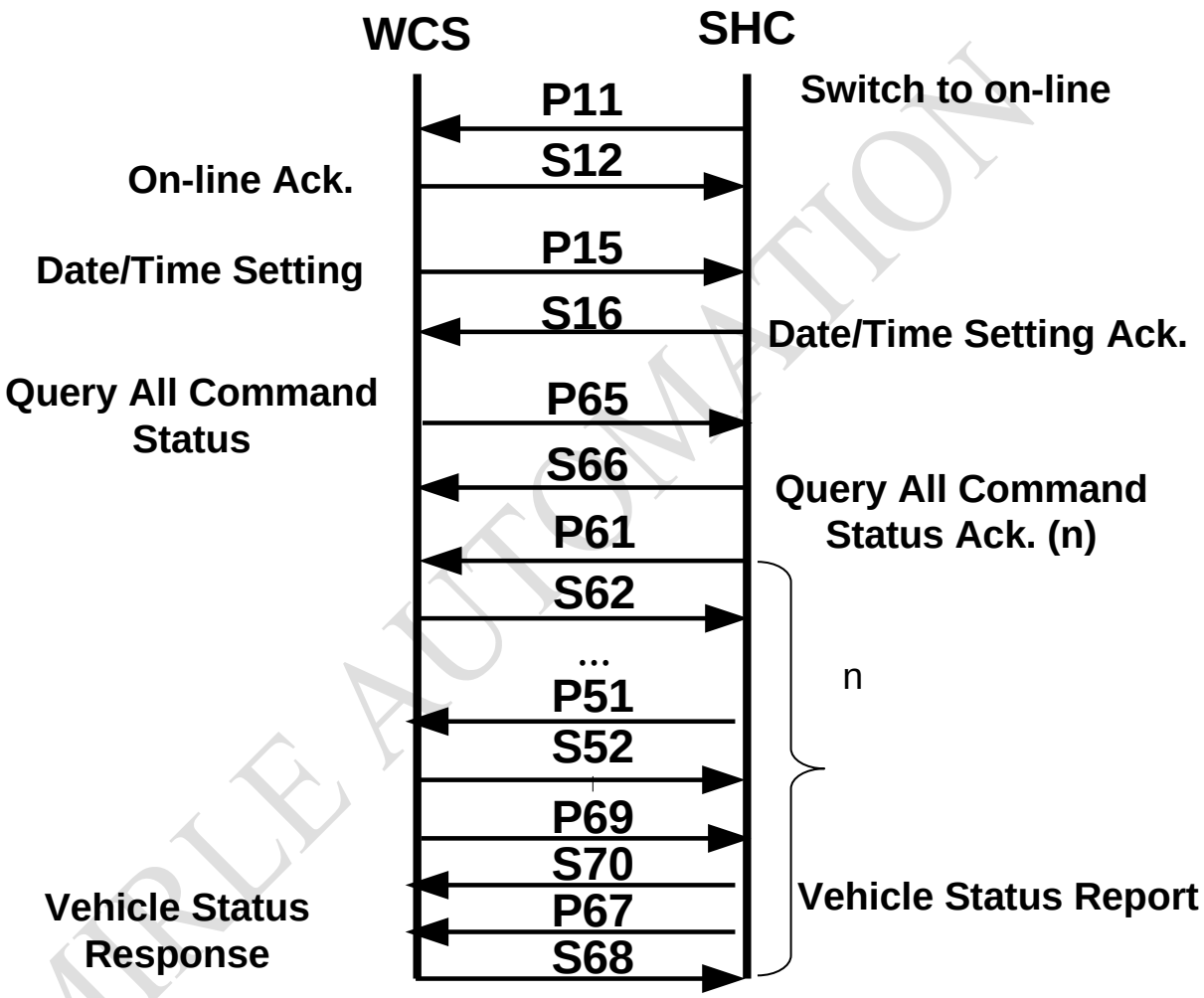
P95	Contents: Block Shelf Report	Direction
	Structure：13 Bytes 1 ~9 Bytes = Shelf ID 10~13 Bytes = Vehicle ID	Wcs ← Shc

S96	Contents: Block Shelf Response	Direction
	Structure：1 Byte 1 Byte = Acknowledge, 0: OK, 1: NG	Shc ← Wcs

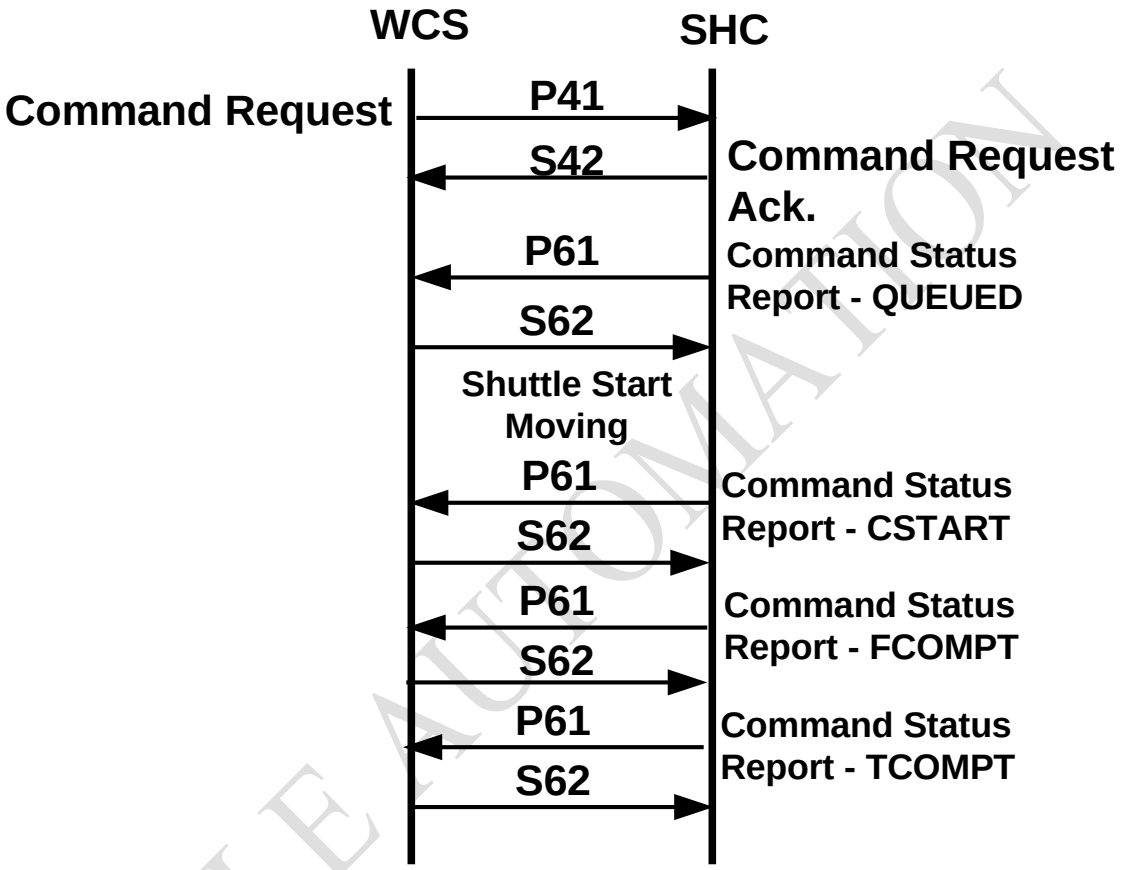
註：因車子資訊及儲位的資料量太大，若有需查詢改由 DB Query, 如 Query Inventory, Query All Vehicles

10. Scenario

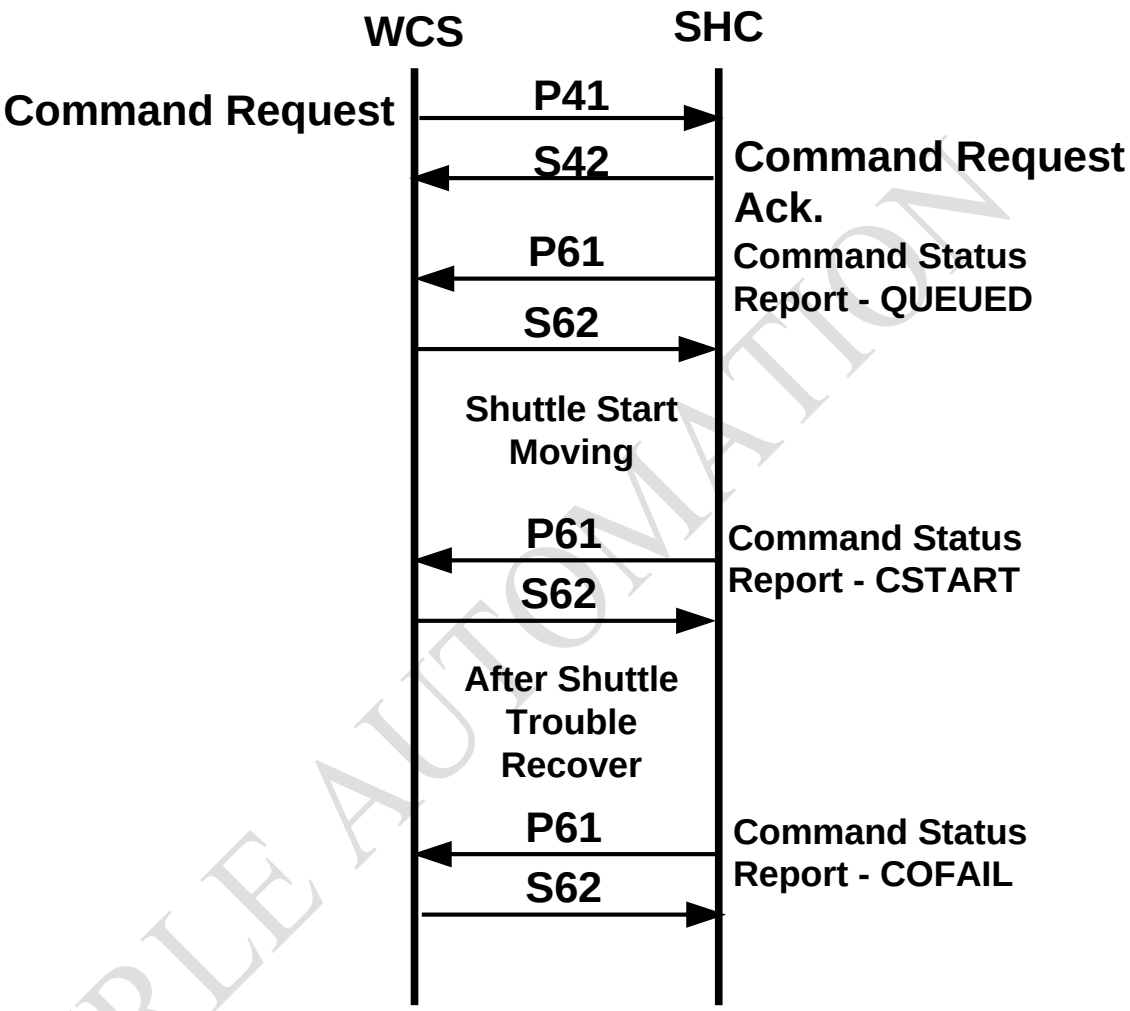
10.1 Online Sequence



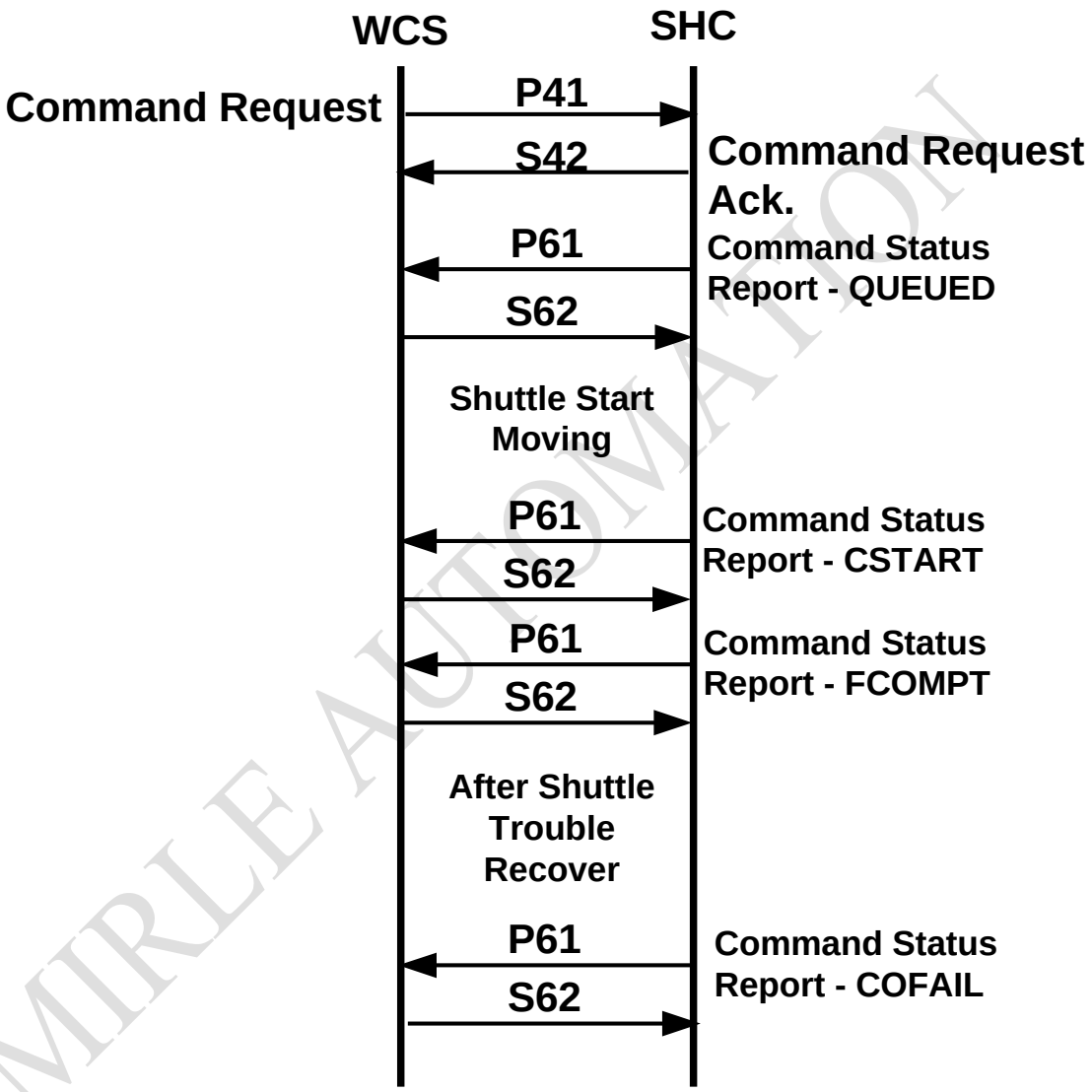
10.2 Normal Transfer



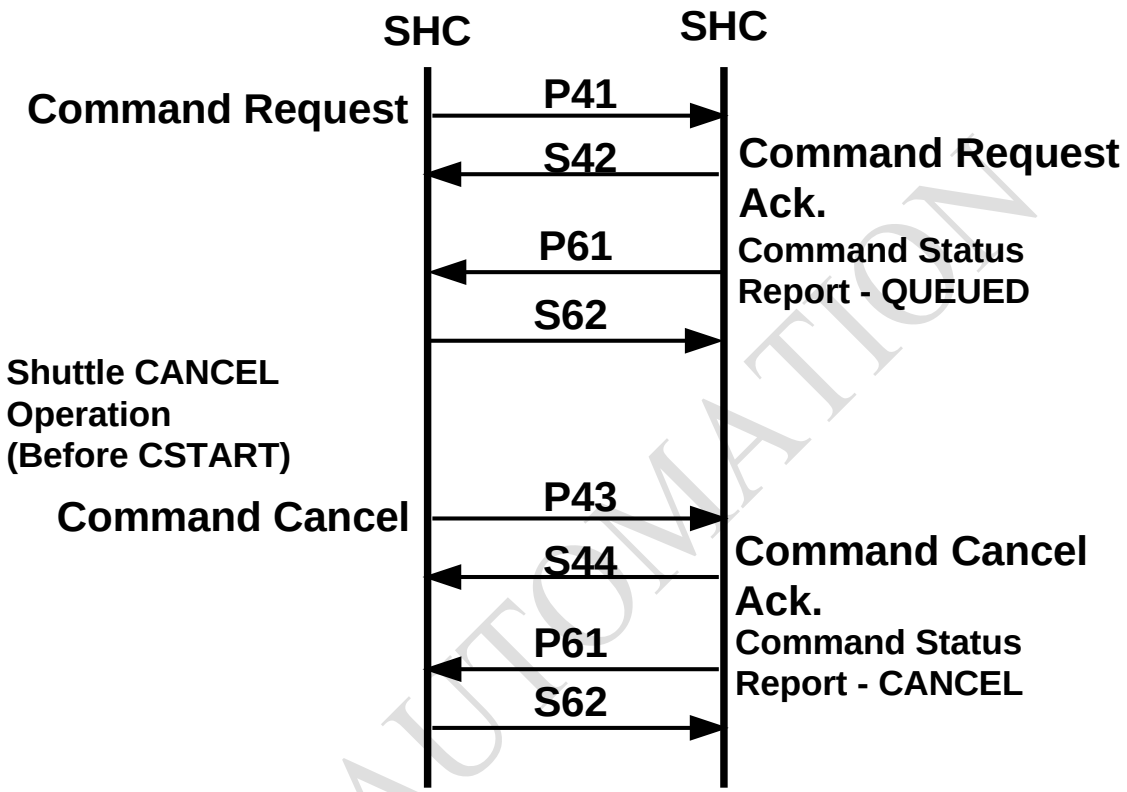
10.3 Transfer Fail – Before Pick Carrier



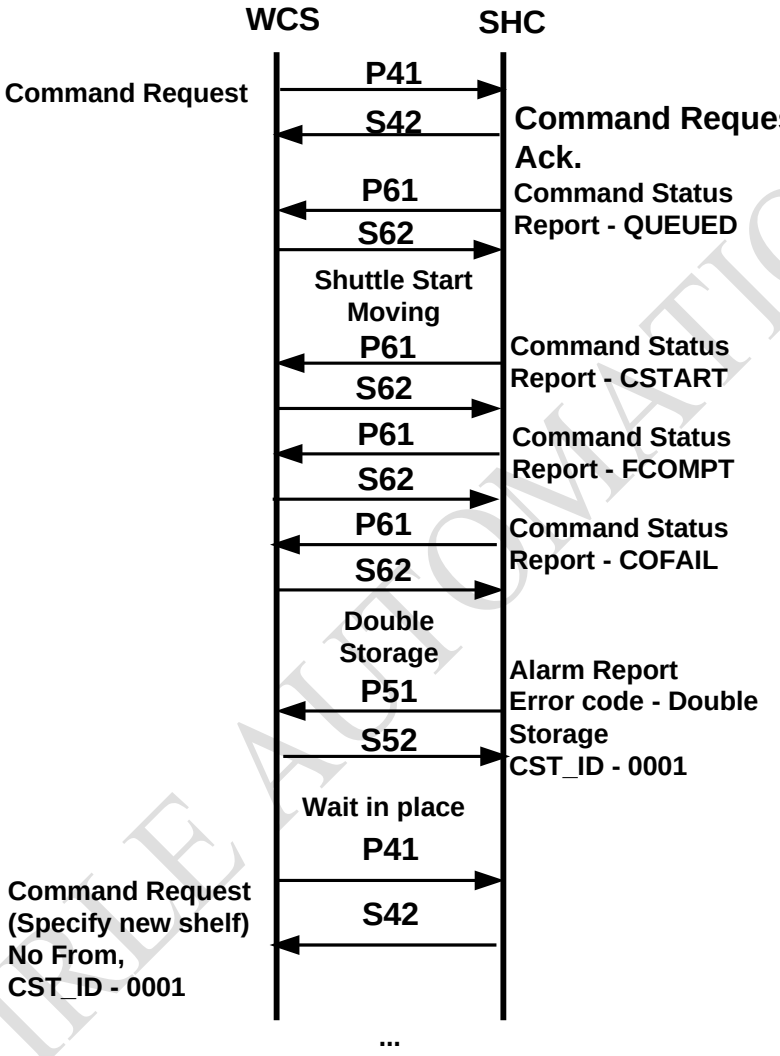
10.4 Transfer Fail – After Pick Carrier



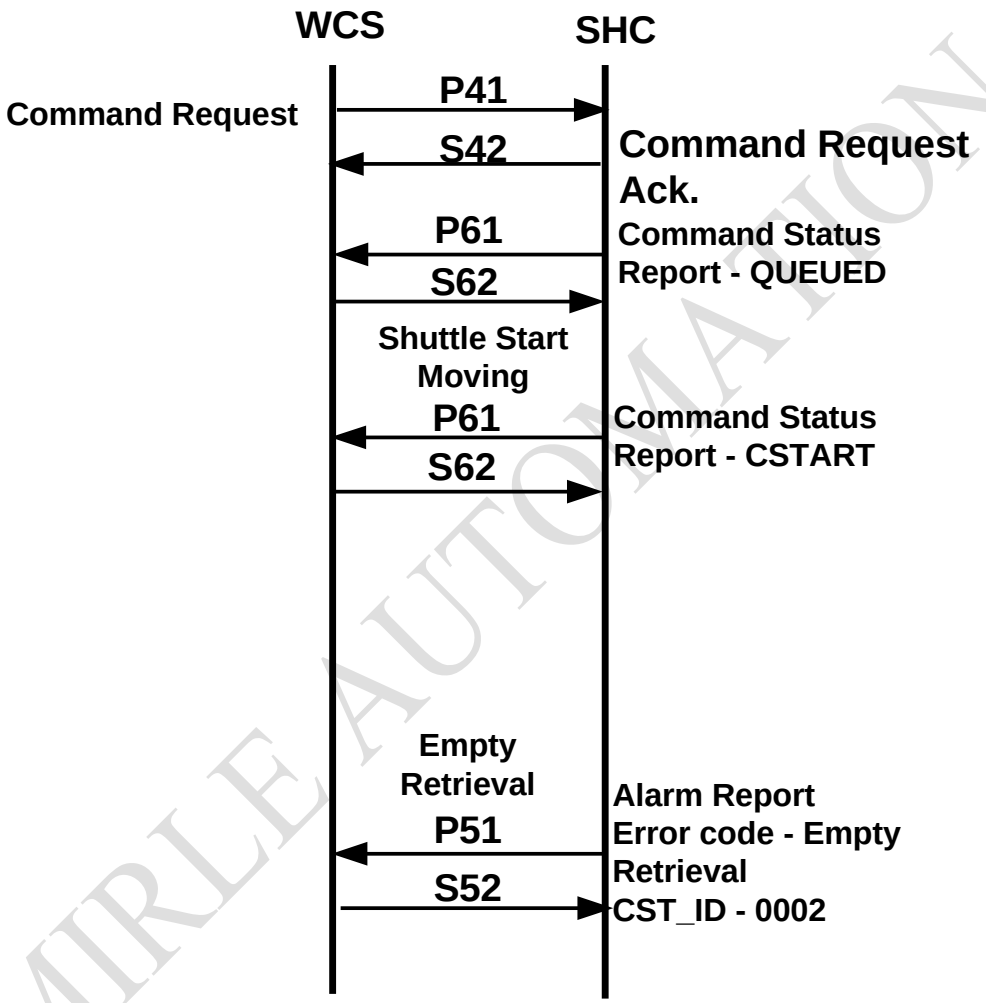
10.5 Cancel Transfer



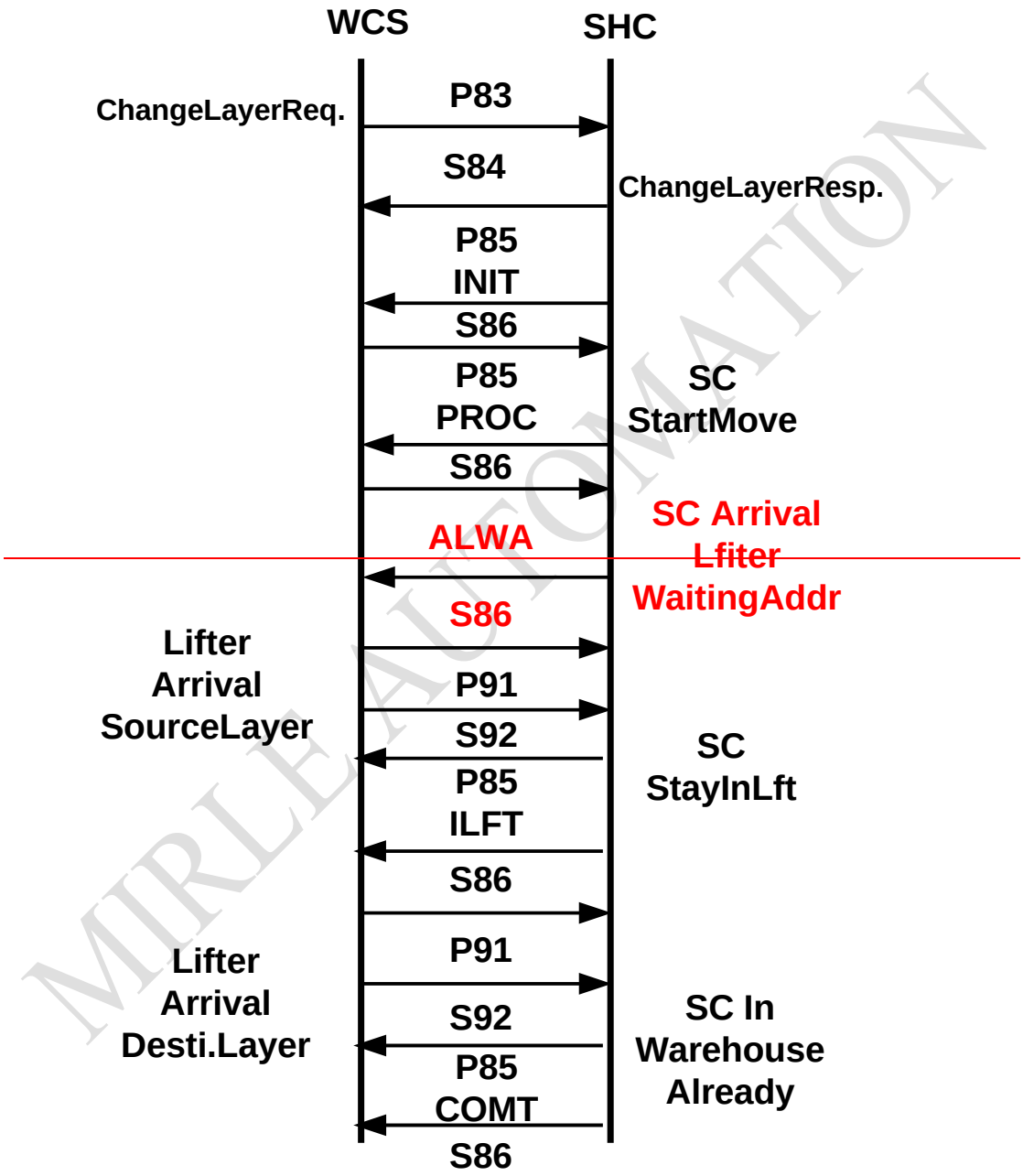
10.6 Double Storage



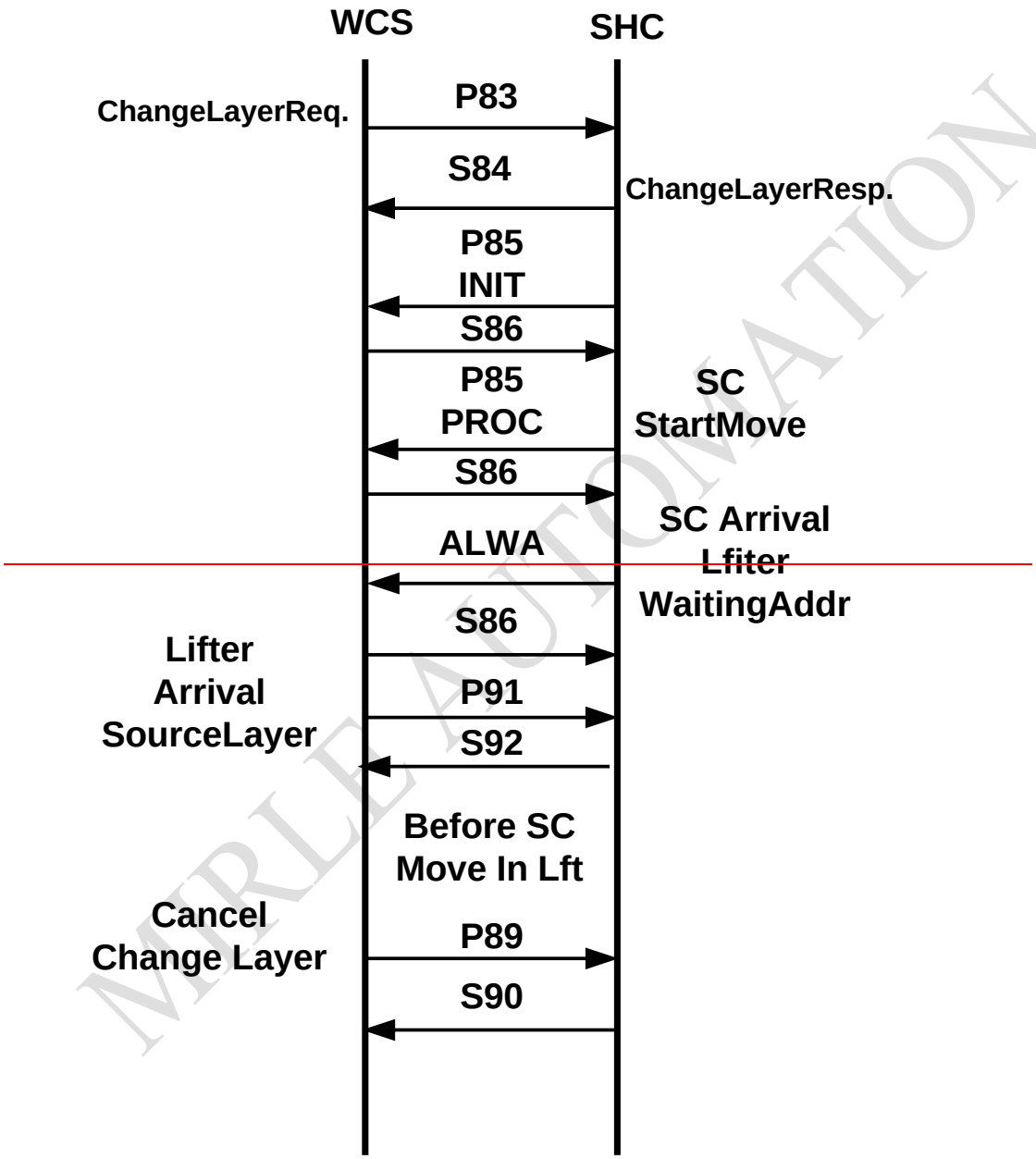
10.7 Empty Retrieval



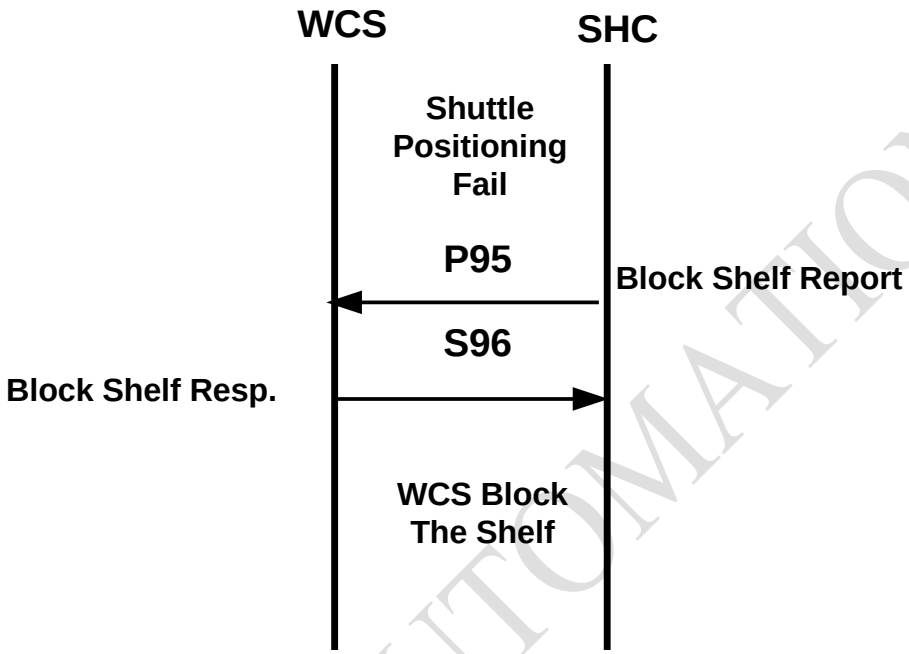
~~10.8 Change Layer~~



~~10.9 Cancel Change Layer~~



10.10 Block Unavailable Shelf



~~10.11 Vehicle Status Change~~