



Function Specification (FncS)

IVSU_Cloud_Function_USB_Updates

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Document ID	547914	
Document Location	VSEM Rich Client , VSEM Thin Client	
Document Owner	Gill, Balwinder (bgill51)	
Document Version	C	
Document Status	Released	
Date Issued	30-Oct-2019 14:07	
Date Revised	30-Oct-2019 16:45	
Document Classification	GIS1 Item Number:	
	GIS2 Classification:	

Document Approval			
Person	Role	Email Confirmation	Date

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Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

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1 Introduction

1.1 Purpose

The purpose of USB Function Specification is to provide the requirements for in vehicle software update through USB. USB software update follows similar process to OTA update except the binaries are delivered via USB drive instead of being downloaded from the IVSU cloud. A USB software update can be done offline as the install and swap authorizations shall to be obtained from the cloud part of the software package.
For USB software the user shall download the software from consumer website or dealer website or engineering.

1.2 Scope

The following functions within used to update the ECUs software thru USB. Light OTA Manager is reference name because functions of OTA Manager maybe allocated differently to different components based on vehicle architecture.

Function ID	Function Name	Owner	Reference
	USB Parser	Balwinder Gill	
	SFTP	Mirela Fonoage	
	Download Manager	Vijay, Jayaraman	
	OTA Manager	Mohamad Nasser	

Table 1: Functions described in this specification

1.3 Audience

The Functional Specific has interfaces with Ford backend and consumer website, and in vehicle ECUs.

1.3.1 Stakeholder List

For the latest list of the feature stakeholder and their roles & responsibilities, refer to <Put VSEM Link here>.

Stakeholder Name	Role
John Vangelov	IVSU team
Brunilda Caushi	IVSU team
Ali Suleiman	IVSU team
Lingxiu Chen	IVSU team
Mohamad Nassir	IVSU team
Aldi Caushi	Security Team
Balwinder Gill	Consumer Website/ HMI SYNC 4/ AppLink
Chad Eslink	Ford IT IVSU/Fenix Manager
Raja Chakrapani	GIVIS Core
Cheryl Kitze	Fenix Cloud
Mike Schanerberger	IVS

1.3.2 Ford Documents

List here all Ford internal documents, which are directly related to the feature.

Reference	Title	Doc. ID	Revision
	OTA Manager		
	Manifest Manager		
	IVSU Trigger Manager		
	VIL Manager		
	Download Manager		
	Install Manager		
	Vehicle HMI		
	Cloud Function SignedCommands		
	Interface Function USB Software Updates		



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	OTA Cloud Interface Specification		
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Table 2: Ford Documents

1.3.3 External Documents and Publications

Reference	Document / Publication
TFAT	See http://msdn.microsoft.com/en-us/library/aa915463.aspx for additional information.

Table 3: External Documents and Publications

1.4 Terminology

1.4.1 Definitions

Definition	Description
VIL	Vehicle Interrogator Log
ECU	Electronic Control Unit
OTA	Over The Air
GIVIS	Global In-Vehicle Software Information
VIN	Vehicle Identification Number
DTC	Diagnostic Trouble Code
ESN	Electronic Serial Number
HMI	Human Machine Interface/Interaction

Table 4: Definitions used in this Documents

1.4.2 Abbreviations

Abbr.	Stands for	Description
FS	Function Requirements Specification / Function Group Specification	The document describing, collecting and developing the requirements of a function or a group of functions.
MSD	Mass Storage Device	USB Mass Storage Device such as a pen-drive. For SYNC purposes, this includes other external devices such as SD cards.
TFAT	Transaction-Safe FAT File System	Transaction-Safe FAT File System allows file modification operations to be interrupted before completion, provides greater protection against power removal and corruption. This is accomplished by storing two copies of the FAT table otherwise it is similar to FAT32, which is commonly used across a wide variety of products.
exFAT (TexFAT)	Extended File system	Extended File system, with extended size and security controls. When the two are combined, it is commonly referred to as TexFAT
MSA	Memory Stick Audio	Don't index (Memory Stick Audio Format)
Fat32	File Allocation Table 32	
NTFS	New Technology File System	
SFTP	Software File Transfer Protocol	

Table 5: Abbreviations used in this documents



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

2 Function Group Description

2.1 Overview

The purpose of this USB function specification is to provide requirements for all the vehicles that are capable to update through USB port. The USB software contents depend on the type of updates received from Ford Backend through consumer website, or service or engineering/development. The USB software update shall be process through the module that has direct interface with USB port and components that are connected with Ethernet for USB component. The OTA software updates are NOT LIMITED to have direct connect with USB port and Ethernet connection, other ECUs can receive USB software updates

2.2 Input Requirements

2.2.1 F-REQ-304795/B-###R_FNC_USB_001### User Consent

The OTA user consent does not affect USB software update because user consent is provided when customer login into consumer website and downloads the latest software.

2.2.2 FUR-REQ-322903/A-###R_FNC_USB_002### Connectivity Status

For all USB software updates vehicle is not required any type of internet connection. CCS settings is not input to USB software update.

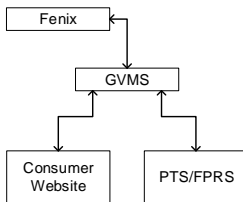
2.2.3 F-REQ-304793/C-###R_FNC_USB_003### Obtain USB Software Files

The Consumer website shall have customer interface for vehicle level OTA software updates. The customer shall be able to download USB software update from the consumer website for various regions and countries.

The Consumer website shall have interface for the customer to upload VIL after the USB update is successful.

The Service website (PTS/FPRS) shall have interface to download the software files and upload the VIL for all USB updates. For all production vehicles, the USB software files shall have VIN # part of the file and folder name unless software update is delivered through secure method.

For USB software update service website shall have interface to VIN signed manifest.



USB software Package shall include valid VIS is in the format that is defined for USB updates.

2.2.4 FUR-REQ-322905/A-###R_FNC_USB_004### Software Release Notes

USB software update shall contain software release notes that can be displayed after the software updates.

2.2.5 F-REQ-304796/B-###R_FNC_USB_005### Rollback to Original Software on Vehicle

For module(s) with memory A and B has to keep a minimum Operating System on the module during any software update to ensure that in case of errors during the software update the module can roll back to the backup partition.

If USB update is approved for erase and replace, then USB software package shall include the current and original software packages, specifically in case of dependency and coordination.



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2.2.6 F-REQ-304794/B-###R_FNC_USB_006### Software Files Security Requirements

All the software released and distributed via USB shall comply with Ford Motor Company Security Software Update Requirements.

USB Software files shall be signed by the method identified for each ECU.

2.2.7 FUR-REQ-322154/A-###R_FNC_USB_007### Software Files Encryption

Software files that are identified as needing encryption, shall be encrypted by Ford Security Cloud System before distributed through OTA. The decryption of the files shall be made from the vehicle client module prior to transferring it to the target ECU.

2.2.8 F-REQ-304798/C-###R_FNC_USB_008### Manifest Signing

All USB manifest file(s) shall be signed by the method identified for each ECU and manifest file shall be VIN signed.

Development software shall support generic manifest file and VIN signed is not required of file name or inside the manifest file.

2.2.9 F-REQ-304790/C-###R_FNC_USB_011### USB VIS

The cloud shall include VIS file in the USB update for the client that is directly/indirectly interfacing with the USB port. The client in this case shall use the VIS in the package to create a VIL and save to the designated location in the USB.

2.2.10 F-REQ-304791/C-###R_FNC_USB_012### Default VIS for USB Update

If the VIS is not present on the update USB, then the vehicle interrogator file shall be generated based on the default VIS. default VIS is store in the vehicle.

2.2.11 F-REQ-304792/B-###R_FNC_USB_013### Service Interface

The service shall have website Interface where they can determine if any updates are available for given VIN.

The service shall have interface with consumer website without login ID requirements, service shall be able to view the latest information available to the customers.

The service website shall have interface to upload VIL after the USB update is successful.

2.2.12 FUR-REQ-322904/A-###R_FNC_USB_014### Vehicle Inhibit (Cloud Signed Commands)

If USB software update that requires vehicle to be inhibited, then USB software package shall include cloud authorization for vehicle inhibit command to be used offline.

For all USB with vehicle inhibit for devolvement software shall have way to provide cloud signed authorization.

2.3 Assumptions & Constraints

This function specific assume that the SYNC or Other similar modules has direct connections with USB port. This specific is not limited to SYNC but also include sub system other **Infotainment Systems** with USB connection and with ECG.



3.1 Function List

Function ID	Function Name	Function Description
<F1>	USB connection Status	USB connection shall monitor USB device status of plugged/unplugged at all time.
<F2>	Vehicle HMI	In vehicle HMI shall show step by step instructions and progress until the software complete or failed. Such as USB device found with software update, download, install, and activation, and release notes after the software update is complete or if failed HMI with failure details and user action.
<F3>	USB Parser	USB Parser shall detect USB device is connected to USB-Port with a valid Ford software update. USB Parser shall provide initial HMI flags USB parser shall set an IVSU Trigger which include URL(s) of files
<F4>	Event IVSU Trigger	The Event IVSU trigger shall notify OTA manager that USB device is inserted with software updates.
<F5>	OTA Manager	OTA Manager has interface with vehicle HMI (more details is in the OTA Manager Function Specific).
<F6>	File Client	Upon request the from file server, the File client shall transfer the request files.
<F7>	Self-Installation Manager	If USB update is for self-Install module, then it shall wait until it receives all required information from OTA Manager.
<F8>	Target ECUs	OTA manager shall install the software on target ECUs.
<F9>	Consumer Website or Service	Consumer and/or Service website shall provide an interface where user can download software package, and upload VIL or post status files.



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	VIL Upload	After USB update is successful the OTA Manager shall trigger the VIL Manager to create a VIL and upload it to provided location. Create a VIL to post at backend and upload it to USB
<F10>	File Server	File server has an interface with File client to download all the software files to ECG.

Table 4: List of Logical Functions



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4 Logical Functions

4.1 USB Software Update

4.1.1 Function Description

The purpose of this function is to provide all the requirements for USB software updates such as to re-flash the full OS/App, re-flash differential OS/APP or any other software files pertaining to the vehicle components.

4.1.2 Function Scope

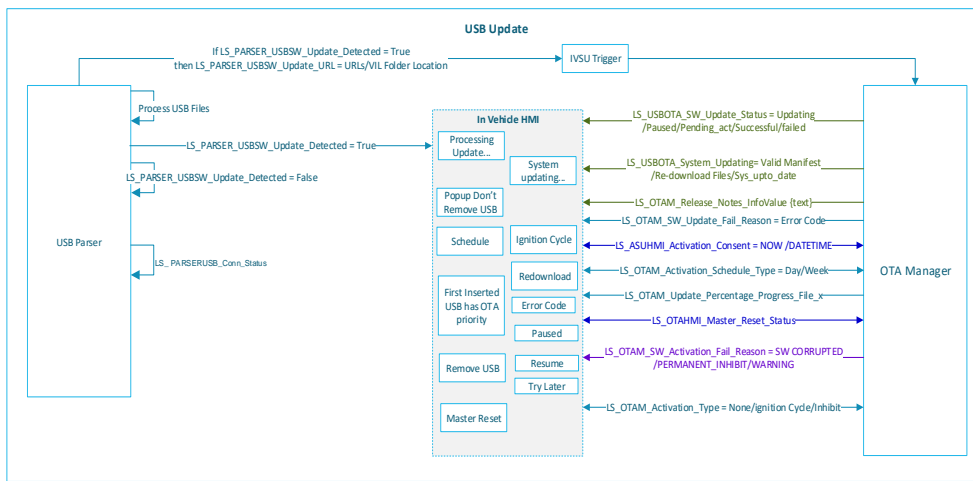


Figure 2: Function USB Update

4.1.3 Function Interfaces

4.1.3.1 Logical Inputs

Signal ID	Signal Name	Description
	LS_USBOTA_System_Updating	Valid Manifest 02 – Re-download Files 03 – System update to date
	LS_USBOTA_SW_Update_Status	Downloading In Progress Pending for activation Failed Successful Paused Resumed
	LS_OTAM_Activation_Type	Activation Type: - No Ignition Cycle Ignition Cycle Inhibit
	LS_OTAM_Release_Notes_InfoValue	Software Release Notes



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	LS_ASUHMI_Activation_Consent	NOW DATETIME
	LS_OTAM_SW_Update_Fail_Reason	Error Code
	LS_OTAM_SW_Activation_Fail_Reason	Software Corrupted Permanent Inhibit USB Failure Warning
	LS_OTAM_Update_Percentage_OverallProgress	Overall software update progress
	LS_OTAM_OTASWB_Number_of_Files	This signal shall show total and remaining number of files.
	LS_OTAM_Activation_Schedule_Type	Day or Week
	LS_OTAM_Activation_Time	Progress of activation
	LS_OTAM_HMI_OTASWB_Clear	USB update is paused and USB configuration time expire or OTA Manager abort the update, then set this signal to clear progress bar and other USB related HMIs.

4.1.3.2 Logical Outputs

Signal ID	Signal Name	Description
	LS_PARSERUSB_Conn_Status	Maintain USB connection status (plugged, unplugged, and re-plugged (same or different) USB device).
	LS_PARSER_USBSW_Update_Detected	The USB Parser shall notify the Event trigger with files types and location of software files and VIL folder. USB parser shall provide an initial flag to HMI when validating the USB for OTA software updates. True/URLs/VIL upload location (VIL Folder creation or default location)
	LS_OTAHMI_Master_Reset_Status	Master Reset or No Master Reset



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

4.1.4 Function Modeling

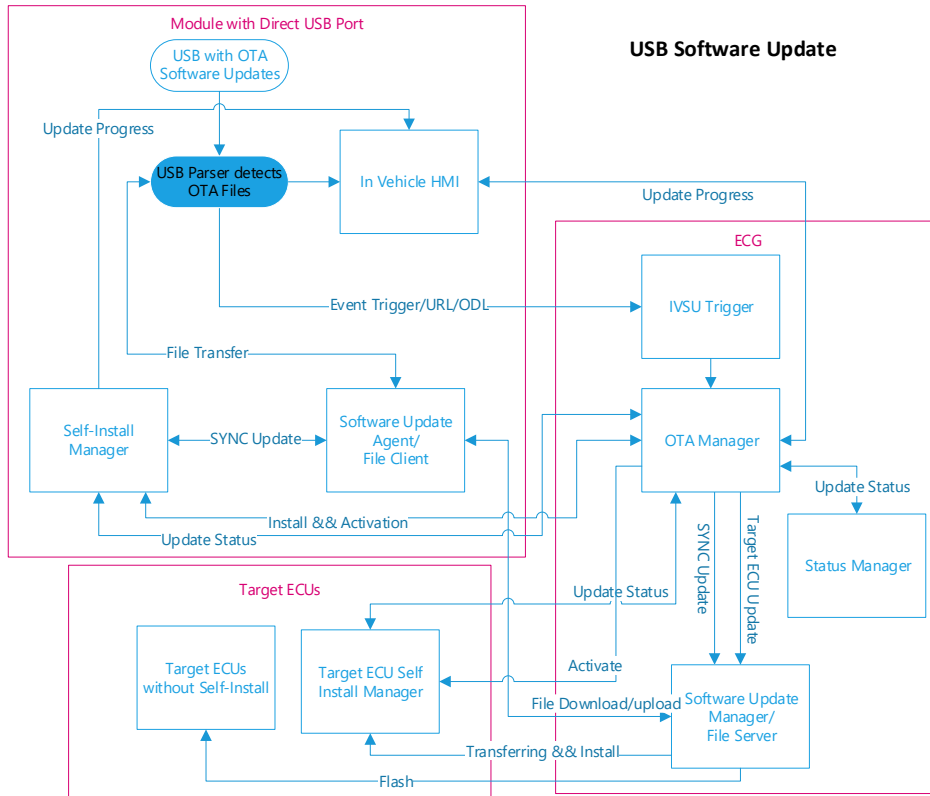


Figure 3: USB Software Update Flow

4.1.5 Function Requirements

4.1.5.1 Functional Requirements

4.1.5.1.1 REQ-329634/A-###R_FNC_USB_015### Type of Software Updates

1. Software update with vehicle inhibit
 - a. Cloud signed authorization file is required for all vehicle inhibits
2. Software updates with normal ignition cycle
 - a. Map and other large file update
3. Software updates without ignition cycle

4.1.5.1.2 F-REQ-304783/B-###R_FNC_USB_016### Software Packages

USB device contains software files that is release in IVS and/or VADR.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

4.1.5.1.3 F-REQ-304762/B-###R_FNC_USB_017### USB Parser Shall Create Folder on USB Root Directory

The USB parser shall create a folder on USB root directory after detecting the USB with software update.
If software update is in progress and/or multiple devices are inserted, then USB Parser shall verify to see if original USB device exist before creating a folder on the USB root directory to upload the post VIL or post status.
If the folder creation fails, then USB OTA software update shall continue with a default location (USB device location) to upload the post VIL or update status.

4.1.5.1.4 F-REQ-304761/C-###R_FNC_USB_018### USB Parser Detecting Software Update

When a USB device is inserted then USB parser shall detect if USB device contains Ford release software files. USB parser can detect software updates by reading the folder and file names.
For customers all files shall be included inside the zip "VIN_FordSoftwareUpdates": VIN_FordSoftwareManifest.der, VIN_VIS File, and VIN_vehicle inhibit cloud signed file.

USB Parser shall provide the following functions for USB Software Updates:

1. Detect vehicle level manifest files, USB Parser shall be able to detect the correct manifest file for that vehicle.
VIN_FordSoftwareManifest.der
2. Detect software folder (zip or unzip), USB Parser shall be able to detect the correct software folder.
 - a. Zip USB Software update folder
VIN_FordSoftwareUpdates
 - b. Un-Zip USB Software update folder
VIN_FordSoftwareUpdates
 - c. If USB has both zip/unzip folders, then zip has priority
If USB was unplugged during unzipping, then restart the process
3. VIS File
 - a. File name shall be VIN_VIS or JSON
4. For vehicle inhibit cloud signed file(s) for software activation commands
 - a. File name shall be VIN_sign_commands or syncP
5. Software release notes

For Service, USB shall contain all software files inside the zip/unzip folder "FordSoftwareUpdates" but manifest file shall be on the USB root directory along with OLD file and vehicle inhibit cloud signed file(s).

For customer USB device: -

One zip folder including VIN_FordSoftwareManifest.der, VIN_FordSoftwareUpdates folder, VIS file, and cloud sign activation commands.

For service USB device: -

Unzip folder for FordSoftwareUpdates
VIN_FordSoftwareManifest.der
VIS file
Cloud sign activation commands
Release notes

4.1.5.1.5 FUR-REQ-324897/A-###R_FNC_USB_019### Multiple Manifest or Folders on USB device

If USB device has multiple manifest files and/or software folders, then USB parser can select correct files for that vehicle.

Manifest File or Folder Name Example: - Vehicle A = 000003, then USB Parser shall detect the correct folder and file for the vehicle.

USB device with 000001_FordSoftwareUpdates and 000001_FordSoftwareManifest.der AND
USB device with 000002_FordSoftwareUpdates and 000002_FordSoftwareManifest.der AND
USB device with 000003_FordSoftwareUpdates and 000003_FordSoftwareManifest.der AND
USB device with 000004_FordSoftwareUpdates and 000004_FordSoftwareManifest.der

4.1.5.1.6 F-REQ-304760/C-###R_FNC_USB_020### Software Package Validation

USB software package can be obtaining from Engineering, Service Website, and Consumer website.

For Service: -

Service website shall have an interface to download the software packages in advance for all vehicles.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

Service website shall have an interface to download VIS and the VIN signed manifest file.

If software updates with vehicle inhibit, service website shall have an interface to download the cloud signed authorization file(s) for USB software update.

For Customer: - Zip file within all required files for USB software update.

Example E\:

- Un-Zip software update folder
- VIS file
- VIN signed Manifest
- Vehicle inhibit cloud sign commands

4.1.5.1.7 FUR-REQ-324898/A-###R_FNC_USB_021### Invalid Manifest File Old or non-Ford Software Files found on USB device

If OTA manager detects invalid manifest file (such as older and/or non-Ford or corrupted) software files on USB, then HMI shall prompt the user shall download the latest files from consumer website before continuing.

[LS_USBOTA_System_Updating = Redownload Files](#)

Service shall use the latest software files for USB updates and delete any older software files.

4.1.5.1.8 REQ-326407/A-###R_FNC_USB_022### Same USB Detected which was updated Previously thru OTA or USB

If OTA manager detects manifest file that was updated previously thru OTA or USB [LS_USBOTA_System_Updating = Sys_is up to date](#), then HMI shall prompt the user that system is up to date, before continuing please re-download the latest files from consumer website.

4.1.5.1.9 F-REQ-304763/B-###R_FNC_USB_023### USB Parser Detection Utilities/Logs

The system shall be able to troubleshoot without interrupting the software update in progress.

The USB parser shall detect if USB contains vehicle and/or module utility files. The USB parser shall distinguish utilities(s) and logs different from OTA software updates.

If the USB contains any utility/logs, then OTA Manager shall not interrupt software updates but shall be able to process utility/logs request.

4.1.5.1.10 FUR-REQ-324899/C-###R_FNC_USB_024### VIS Not Found on USB Device

If USB parser does not find VIS file on the USB device, then USB parser shall skip VIS file and continue with software update.

4.1.5.1.11 F-REQ-304765/C-###R_FNC_USB_025### USB Parser Shall set IVSU Trigger

Each time USB device is detected with Ford software update, then USB parser shall set an IVSU Trigger and it shall include URL(s) of manifest file, VIS files, and vehicle inhibit cloud signed authorization file(s).

All software update with vehicle inhibit shall include a cloud signed authorization file(s) part of the USB software package.

If [LS_PARSER_USBSW_Update_Detected = True](#), then [LS_PARSER_USBSW_Update_URL = URLs/VIL](#) upload location.

4.1.5.1.12 FUR-REQ-324900/A-###R_FNC_USB_026### Decrypt USB Software Files

If Software file are encrypted, then OTA system shall have method to decrypt the software files before transferring it to target ECU.

4.1.5.1.13 FUR-REQ-322743/A-###R_FNC_USB_027### IVSU Authorization for USB Updates

For all USB Software update in vehicle authorization & PII data is not required.

4.1.5.1.14 FUR-REQ-324902/A-###R_FNC_USB_028### Software Update for Self Install ECU(s)

If USB update is for a self-install ECU, then OTA Manager shall command self-install ECUs to download and install the software files one at a time until all the files are downloaded and installed.

Self-Install ECU shall report download and install progress status to OTA Manager and wait for the software activation command from OTA Manager.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

4.1.5.1.15 FUR-REQ-324903/A-###R_FNC_USB_029### Download Software files from USB device (File Transfer)

Software update manager shall request Software update agent to start downloading list of files and upload the files to SFTP Server.

4.1.5.1.16 FUR-REQ-324904/A-###R_FNC_USB_030### Software Download Failure

If software download failed, then HMI shall display message with details of the failure codes and next steps for the customer.

4.1.5.1.17 FUR-REQ-324905/A-###R_FNC_USB_031### Navigation/Map or Large File Software Update

If update is a large file and/or Map/Nav software updates which requires more memory than what is available on ECU, then it shall NOT download the files into the component cache but it shall use one of the other methods to complete the update.

Large file Method: -

- Directly install from USB device – Default method
- Unzip the file on USB device
- Extract in place

During Software update is USB if removed then prompt the user to reinsert the USB to continue with software updates.

[LS_PARSERUSB_Conn_Status = USB_unPlug && LS_USBOTA_SW_Update_Status = Paused](#)

4.1.5.1.18 FUR-REQ-322744/A-###R_FNC_USB_032### Vehicle Connection Status

For all USB software updates vehicle does not require an internet connection. But if connection is available then OTA Manager shall post the VIL addition to uploading it on USB device.

4.1.5.1.19 F-REQ-304764/B-###R_FNC_USB_033### File Transfer Over Unlimited Ignition Cycles

The File Transfer shall start and maintain the copy process over unlimited ignition cycles (ignition cycle = ACC/Start). The USB shall be capable of switching between different connectivity ports mechanisms during a binary data transfer process. Upon request to transfer files File Transfer shall start transferring the all files to target location. The USB update shall be able to do a binary data transfer without impairing normal functionality.

4.1.5.1.20 F-REQ-304779/B-###R_FNC_USB_034### Master Reset when USB update is in Process

If USB software is downloading or installing or pending activation and customer initiate a master reset, then HMI shall prompt the user that update is in progress, would you like to continue with master reset.

During master reset OTA system shall continue to update until completion, but if system cannot continue, then it shall pause the update during system restart and resume after the system restart is complete.

[LS_Master_Reset_Status = MasterReset](#)

4.1.5.1.21 FUR-REQ-322912/A-###R_FNC_USB_035### Service Troubleshooting USB Update

Service shall have the ability to see why the USB software update failed. DID shall provide similar information for USB as it did for the OTA software updates.

Service shall access update status by \$D03C for OTA and USB updates.

4.1.5.1.22 FUR-REQ-328717/A-###R_FNC_USB_036### USB Update with Inhibit and Vehicle Precondition are not met

If the vehicle conditions are not met for vehicle inhibit, then in vehicle HMI shall prompt the user "Software update cannot complete and take following actions before you can continue with software updates."

1. Turn off ignition
2. Battery is too low to start and complete the software update
3. Vehicle has diagnostic codes that requires the vehicle to be service before you can continue with software updates.
4. Etc. (Reference: more detailed in the HMI function s

4.1.5.1.23 F-REQ-304768/B-###R_FNC_USB_037### Software Update Prioritization

Software update priority defined by the OTA Manager based on the OTA policy table.

Example:

1. CAN Flash: tool is directly connected with OBD port

Document Owner: Gill, Balwinder (bgill51)

GIS1 Item Number:

GIS2 Classification:

Document ID: 547914

Date Issued: 30-Oct-2019 14:07

Date Revised: 30-Oct-2019 16:45



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

- a. If OTA update is in process, then pause the OTA update and start and finish the CAN flash before resuming with OTA.
 - b. During activation OBD is blocked (vehicle inhibit blocked OBD)
 - i. Once activation is complete or failed OBD shall be unblocked
 - c. If flashing through OBD an ECU is programming mode, then OTA manager shall not activate the software
2. USB Update
 - a. If the ECU that is currently being updated through OTA and installing the software files, then wait for OTA to complete before starting with USB update.
 - b. If USB update shall NOT trigger during activation both (A/B or E/R).
 3. OTA Update

4.1.5.1.24 F-REQ-304769/B-#### FNC_USB_038### OTA Trigger while a USB update in progress

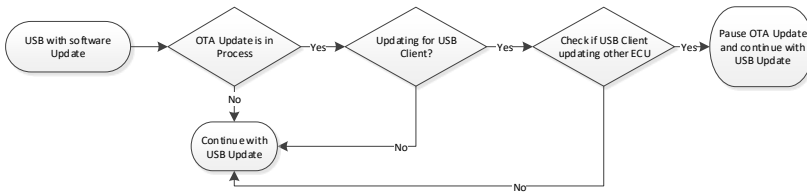
During USB update if same ECU OTA trigger occur, then OTA Manager shall keep track of USB Update (Event_Trigger) while in process and wait for the USB update to complete (passed/failed). If USB update is paused, then OTA Manager shall wait until configurable time before continuing with OTA trigger.

4.1.5.1.25 FUR-REQ-324906/A-#### FNC_USB_039### OTA Trigger while a USB Update in Progress for Different ECU

During USB update if different ECU OTA trigger occur, then OTA Manager shall keep track of USB Update (Event_Trigger) while in process and wait for the USB update to complete (passed/failed) if OTA cannot process the both updates. If USB update is paused, then OTA Manager shall continue with OTA trigger and update.

4.1.5.1.26 F-REQ-304770/B-#### FNC_USB_040### USB update for USB client while USB client updating other ECU thru Ethernet and/or OVTP

If the client is updating target ECU and receives update for itself, then the client module shall update its software strategy without an impact to the update in progress of another ECU. If the client cannot continue the update of another ECU while doing the update of itself, then the update of the other ECU shall be paused and resumed after the client module completes its update.



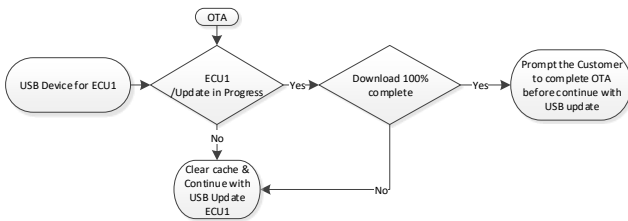
Flow 1: USB Software Update vs OTA Software Update

4.1.5.1.27 FUR-REQ-323044/A-#### FNC_USB_041### USB Update for same ECU that is currently being updating through OTA and files are 100% downloaded

USB Update for the same ECU that is currently being updated through OTA and software package is 100% downloaded and installation is in process, then prompt the user that OTA installation is in process and wait until software update is complete and try again.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates



Flow 2: USB Software Update for ECU1 when OTA download is complete for ECU1

4.1.5.1.28 FUR-REQ-323046/A-###R_FNC_USB_042### USB Update for same ECU that is currently being updating thru OTA download is in Process

USB Update for the same ECU that is currently being updated through OTA and download is in process [LS_OTAM_SW_Download_State = IN_PROGRESS](#), then OTA system shall delete the currently downloaded files and process with USB software updates.

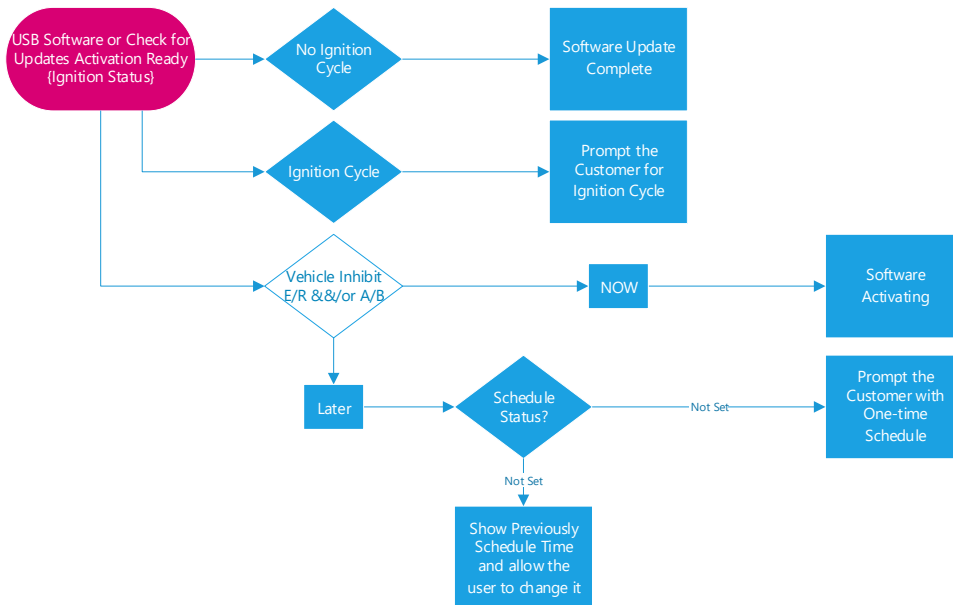
4.1.5.1.29 F-REQ-304782/B-###R_FNC_USB_043### OTA Software Activation NOW for both USB and Check for Updates

For all USB software updates, the user shall have capability to activate the software NOW or Later for both inhibit and non-inhibit types of software's.

1. Software or direct configuration activation does not require ignition cycle [LS_OTAM_Activation_Type = NONE](#) && [LS_USBOTA_SW_Update_Status = SUCCESSFUL](#), then HMI shall not prompt to the customer for any action.
2. Software activation is pending for ignition cycle [LS_OTAM_Activation_Type = IGNITIONCYCLE](#) && [LS_USBOTA_SW_Update_Status = PENDING_Activation](#), then HMI shall prompt the user for an ignition cycle to complete the software update.
3. Software activation requires a vehicle inhibit [LS_OTAM_Activation_Type = INHIBIT](#) && [LS_ASUHMI_ASU_ReoccurringSchedule = FALSE](#) && [LS_USBOTA_SW_Update_Status = PENDING_Activation](#), then OTA Manager shall prompt the user to activation NOW or set a schedule for later with one-time schedule option [LS_OTAM_Activation_Schedule_Type = Day](#).
4. Software activation requires a vehicle inhibit [LS_OTAM_Activation_Type = INHIBIT](#) && [LS_ASUHMI_ASU_ReoccurringSchedule = True](#) && [LS_ASUHMI_ASU_ScheduleTime = time](#) && [LS_OTAM_Activation_Schedule_Type = Weekly](#) && [LS_USBOTA_SW_Update_Status = PENDING_Activation](#), then OTA Manager shall prompt the user to activation NOW or set a schedule for later. If customer schedule for later, then HMI shall show previously set date and time (reminder schedule screen) and allow the user to change it.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates



Flow 3: USB Software Activation Type

4.1.5.1.30 FUR-REQ-324907/A-###R_FNC_USB_044### USB Update During Software Activation

During software activation [LS_OTAM_Activation_Type = INHIBIT && LS_OTAM_Vehicle_Inhibit_Type = ProgrammingSession](#) or [ActivatingNOW](#), then USB Parser shall ignore the USB device with software update until activation is complete.

4.1.5.1.31 F-REQ-304771/B-###R_FNC_USB_045### Vehicle Crash while USB Parser and/or SFTP Transfer is transferring the files

If vehicle is in crash and crash CAN signal is present, then USB parser/SFTP Transfer shall clear the software update. USB update shall restart from beginning once the CAN signal clears the crash alert.

4.1.5.1.32 FUR-REQ-326796/A-###R_FNC_USB_046### eCall during USB software update in progress

If eCall occurs when software is in progress, then system shall pause and resume the software update [LS_USBOTA_SW_Update_Status = Pause](#).

4.1.5.1.33 F-REQ-304772/B-###R_FNC_USB_047### USB Update for Different ECU, then what is in Progress through OTA (Download, Install, and Activation)

The customer inserts an USB device with software update for a different ECU than what is in progress through OTA, then OTA Manager shall process the USB update at highest priority and continue with USB update until completion pass or fail.
Example: -

ECG is wait for set schedule – download installation is already done
Use has USB with SYNC updates



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

Continue with USB update until completion

4.1.5.1.34 F-REQ-304773/B-####_FNC_USB_048### USB connection Status

The USB parser shall keep track of USB device connection status as plugged and unplugged.

[LS_PARSERUSB_Conn_Status = USB_plug](#) or [USB_Unplug](#)

4.1.5.1.35 F-REQ-304766/B-####_FNC_USB_049### USB Lost Connection during File Download and/or File Transfer

During download process if the USB device is unplugged/disconnected due to (unplugged by the user, lost USB connection, power reset, ignition cycle etc.), then save offset and prompt the user to re-plug the USB device ([LS_PARSERUSB_Conn_Status = USB_Unplug](#) && [LS_USBOTA_SW_Update_Status = Paused](#)). Upon USB reconnect, the OTA Manager shall compare the manifest files before resuming the download.

- If system detects current manifest, then the module shall resume the download.
- If system detects new manifest, then system shall clear the cache before it starts downloading the new files.
- If system detects older manifest, then system shall abort the USB update and display notify through HMI.

When USB is unplugged OTA Manager shall pause the update and wait until configured time before abort and clear the update [LS_OTAM_HMI_OTAUSB_Clear = ConfigtimeExpire](#).

There are multiple scenarios that USB will be interrupted, software update shall be designed carefully to make sure software update can be pause and resume properly after each interruption.

4.1.5.1.36 F-REQ-304767/B-####_FNC_USB_050### USB Lost Connection during Install

If installation is in process and USB device is not required for installation, if USB gets unplugged/disconnected (unplugged by the user, lost USB connection, power reset), then system shall continue with software update until completion.

If USB device is required for software installation, then OTA manager shall pause the update and prompt the user to re-plug the USB device. If [LS_PARSERUSB_Conn_Status = USB_Unplug](#) && [LS_USBOTA_SW_Update_Status = Paused](#) during upload.

4.1.5.1.37 F-REQ-304774/B-####_FNC_USB_051### New Software USB is Detected when pervious USB update was paused

During USB software update if [LS_USBOTA_SW_Update_Status = Paused](#) and, user plug USB device with newer software update, then OTA system shall clear the downloaded files and HMI logic shall clear reset HMIs

[LS_OTAM_HMI_OTAUSB_Clear = ResetHMIs](#) before continuing with newer software update.

4.1.5.1.38 FUR-REQ-324909/A-####_FNC_USB_052### Multiple USB Device Plugged in with Software Updates

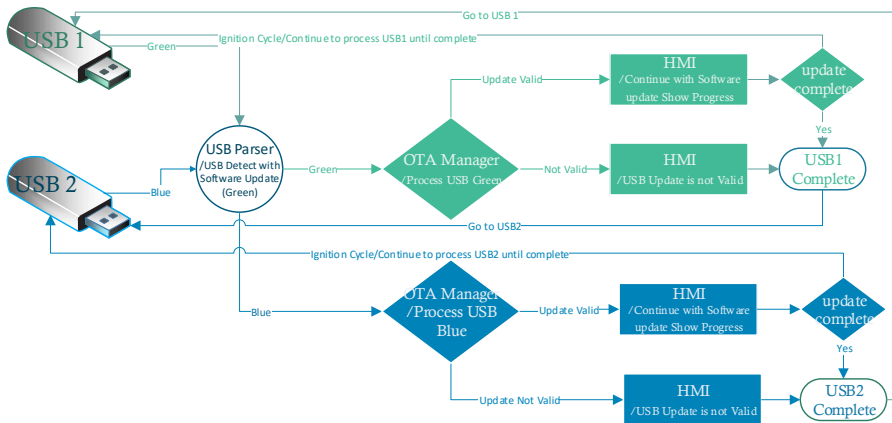
If more than one USB devices are inserted with software update, then USB parser shall start updating with first USB before continue with second USB device.

If USB update is paused and user insert same USB, then software update shall resume.

If it's different USB, then OTA system shall clear the pause software update and process the latest USB.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates



Flow 4: Multiple USB detected with Software Update

Example:

USB1 has Ver 1.0

USB2 has Ver 2.0

USB1 is plugged and the update is not complete (paused)

USB1 is unplugged

USB2 is plugged

If different then delete the files from USB1 and proceed with update trigger from USB2

4.1.5.1.39 F-REQ-304776/B-###R_FNC_USB_053### Maximum Programming Time during Ignition Off

The USB update process (download and install) shall be maintain during extended key cycle in VHM mode.

4.1.5.1.40 F-REQ-304777/B-###R_FNC_USB_054### USB Update while previous Software Activation is Pending

The vehicle is waiting for software activation but user inserted a USB device with new Ford software. The OTA system shall check if update is for same ECU or different ECU.

If USB update trigger for same ECU that is currently pending for activation, then OTA manager shall check the schedule time and prompt the user if schedule time is set, then show the schedule screen with day/time or schedule time is Null, then the schedule screen. If vehicle conditions are not met, then prompt the user with reason why update was not complete and what is the next steps to resolve it; [LS_OTAM_No_ProgSession_Preconditions_Supported = value\(s\)](#) reference REQ-326157 in HMI spec.

If USB update trigger for different ECU, then OTA manager shall process the USB software update request at highest priority.

4.1.5.1.41 FUR-REQ-324910/A-###R_FNC_USB_055### Software Activation During PHEV Charging

If software activation requires a vehicle inhibit [LS_OTAM_Activation_Type = INHIBIT](#), then OTA Manager shall disable PHEV changing to activate the software.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

Note: USB software download and installation doesn't have any limitation during PHEV charging

4.1.5.1.42 FUR-REQ-324911/A-###R_FNC_USB_056### Service Tool Clearing the Software Update and Reset HMI

When the dealer/engineer tools request to clear for software updates, then OTA manager shall clear the software update and related HMIs. Service can clear reset the HMI screens to default through diagnostic tool.

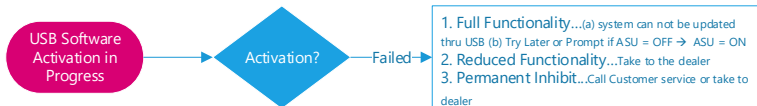
4.1.5.1.43 F-REQ-304780/B-###R_FNC_USB_057### Progress Bar when Failure Occurs

After maximum retried if software update failed, then HMI shall prompt the customer with failure and show the failure on the progress bar. If software update is cleared by OTA Manager **LS_OTAM_HMI_OTAUSB_Clear = ClearHMIs**, then HMI shall reset the progress bar and other related HMIs.

4.1.5.1.44 FUR-REQ-323043/A-###R_FNC_USB_058### Software Activation Failed and Vehicle is Fully Functional

If USB Software update is failed **LS_OTAM_SW_Activation_Fail_Reason = USB_FAILURE**, then HMI shall notify the user that software update is failed but it is not critical failure and does not affect your vehicle functionality. HMI shall notify the user with failure and HMI logic shall determine if User consent screen needed to be displayed or schedule need to be set.

- For Example: - if ASU = On, then system can retry software update automatically or user can re-download the files to try the update
- If ASU = OFF, then HMI logic shall display ASU screen
- If ASU = OFF due to CCS = OFF, then HMI logic shall display the CCS screen



Flow 5: Software Activation Failed

4.1.5.1.45 FUR-REQ-324914/A-###R_FNC_USB_059### Software Activation Failed and Vehicle has Warning

If USB Software update is failed **LS_OTAM_SW_Activation_Fail_Reason = WARNING** and vehicle has reduced functionality, then prompt the user with follow-up action.

- Retry USB Update
- Take it for service
- LS_OTAM_SW_Activation_Fail_Reason = PARTIAL**, then take to the closest dealer

4.1.5.1.46 FUR-REQ-326797/A-###R_FNC_USB_060### Software Activation Failed and Vehicle has Warning

If USB Software update is partially failed **LS_OTAM_SW_Activation_Fail_Reason = PARTIAL**, then vehicle has reduced functionality and requires service.

4.1.5.1.47 FUR-REQ-324915/A-###R_FNC_USB_061### Software Activation Failed and Vehicle Requires Service Action

If USB Software update is failed **LS_OTAM_SW_Activation_Fail_Reason = PERMANENT_INHIBIT**, then HMI shall notify the user with notify that vehicle inoperable and requires service.

4.1.5.1.48 F-REQ-304784/B-###R_FNC_USB_062### Successful Update

After USB software update is complete, then HMI shall show notify and an ICON on the display to notify the customer that update was successfully complete. **LS_USBOTA_SW_Update_Status = Successful**. Software successful HMI ICON shall have stay on the display for 3 ignitions cycles.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates



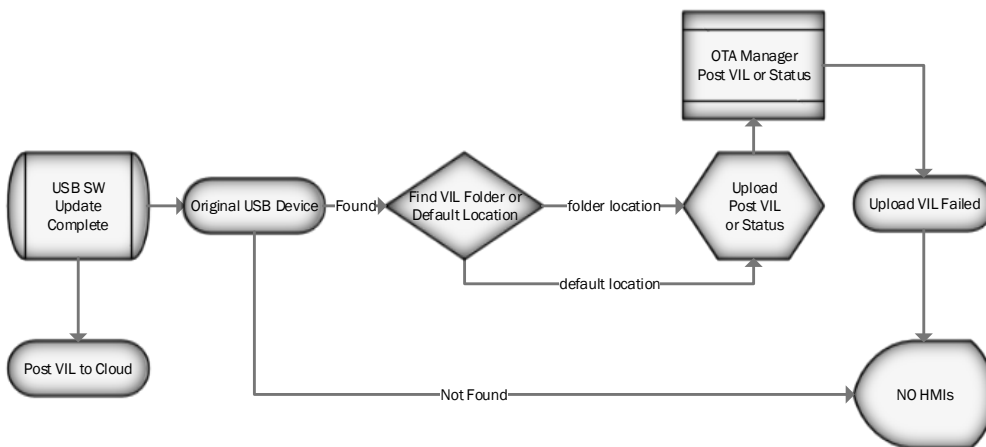
Flow 6: Software Activation Successful

4.1.5.1.49 REQ-324984/A-###R_FNC_USB_063### Upload Post VIL to USB

After the USB update is complete, the OTA Manager shall generate a Post VIL and transfer it to USB device through SFTP and post to the cloud through OTA trigger. The client module shall wait for the USB update to complete or fail before sending the snapshot to the cloud. If the USB update is paused, then the snapshot will be generated and posted to the cloud, however the USB software update information shall be send along with the snapshot.

4.1.5.1.50 F-REQ-304781/B-###R_FNC_USB_064### VIL or Post Status Creation After USB Update Complete

After USB software update is complete, the OTA manager shall post VIL to USB device but if VIL creation fails then OTA manager shall create a post status file with reason of VIL creation failure.
If original USB doesn't exist, then skip upload the post VIL or post status.



Flow 7: Upload Post VIL to USB Device and Ford Backend

4.1.5.1.51 FUR-REQ-324917/A-###R_FNC_USB_065### Software Update is Complete Remove the USB

Once software update is complete, then OTA manager shall set a flag for HMI to prompt the customer to remove the USB update. LS_USBOTA_SW_Update_Status = Successful
HMI shall show date and time when software update was complete under HMI settings.

4.1.5.2 Normal Operation

The USB software update shall be able to download and install without impairing normal vehicle functionality.

4.1.5.3 Error Handling

The following table shows common errors and expected behavior for the installer for each:

Parameter ID	Parameter Name	Description
--------------	----------------	-------------

Document Owner: Gill, Balwinder (bgill51)
GIS1 Item Number:
GIS2 Classification:



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

	Cache Full	Module doesn't have enough memory to process the update
	Manifest invalid	Manifest file in corrupted, older manifest file, and missing required files.
	Installation package returned error	Fail the installation and reset installation mode.
	USB Removed	USB Removed during manifest download and/or software download
	Install Signature	Fail the installation
	Reboot/Reset	Continue installation session from last saved point. A checkpoint should be saved for download progress and after each installation file processed
	Cannot read from USB	If USB device is unreadable then system shall skip uploading the VIL
	Cannot write to USB	If USB device does not allow to write, then skip uploading VIL
	Battery Voltage Low	Save offset and wait for full power mode to continue download/installation session from last saved point.
	USB with Media Files or software files	Download in progress and second USB port user inserted Media USB device, files download shall continue.
	Vehicle Modes	As long as vehicle has power USB update shall continue to download and install.
	eCall/Phone	eCall in progress, Download/installation shall pause During phone call download/installation shall continue
	Crash	If vehicle is in crash, then clear the software update and resume after crash signal is cleared. HMI shall reflect the change
	Ignition Cycle	Download and install shall continue after ignition off
	Master Reset	Master reset shall not effect USB download/installation of the software files.

Table 7: Error Handling

4.1.5.3.1 FUR-REQ-328365/A-####R_FNC_USB_066### Battery Requirement during USB Update

- If battery is too low when USB device is detected and system cannot process the USB then, then notify the user with action required in order to proceed.
- If battery is too low during software download and install, then system shall follow pause and resume to continue the USB updates.
- If battery is too low during software activation, then notify the user that current battery state doesn't allow the activation to complete

4.1.5.4 Non-Functional Requirements

4.1.5.4.1 F-REQ-304786/B-####R_FNC_USB_067### Security Compliance

All the software released and distributed via OTA or USB shall comply with Ford Motor Company Security Software Update Requirements.

4.1.5.4.2 F-REQ-304787/B-####R_FNC_USB_068### USB Parser Response

USB Parser shall response with in 10sec of the plugin USB device.

4.1.5.4.3 F-REQ-304788/B-####R_FNC_USB_069### System Updates Transient Message shall be clickable

The HMI team shall design a System Updates ICON when user clicks it user shall always able to display some progress. Even though when file transfer has not start and it might be difficult to calculate the progress.

Example: -

Click transient message on HMI → Progress bar



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

5 HMI Functions

5.1 HMI Function

5.1.1 Function Description

HMI Function requirements shall provide the user feedback for the download and installation operation, unless the manifest file explicitly disables notifications. HMI shall provide status update with percentage of the download, install, and any error occur during the USB update. HMI shall display [notify](#) for if USB contains invalid files, if USB is remove during the update process etc.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

5.1.2 Function Scope

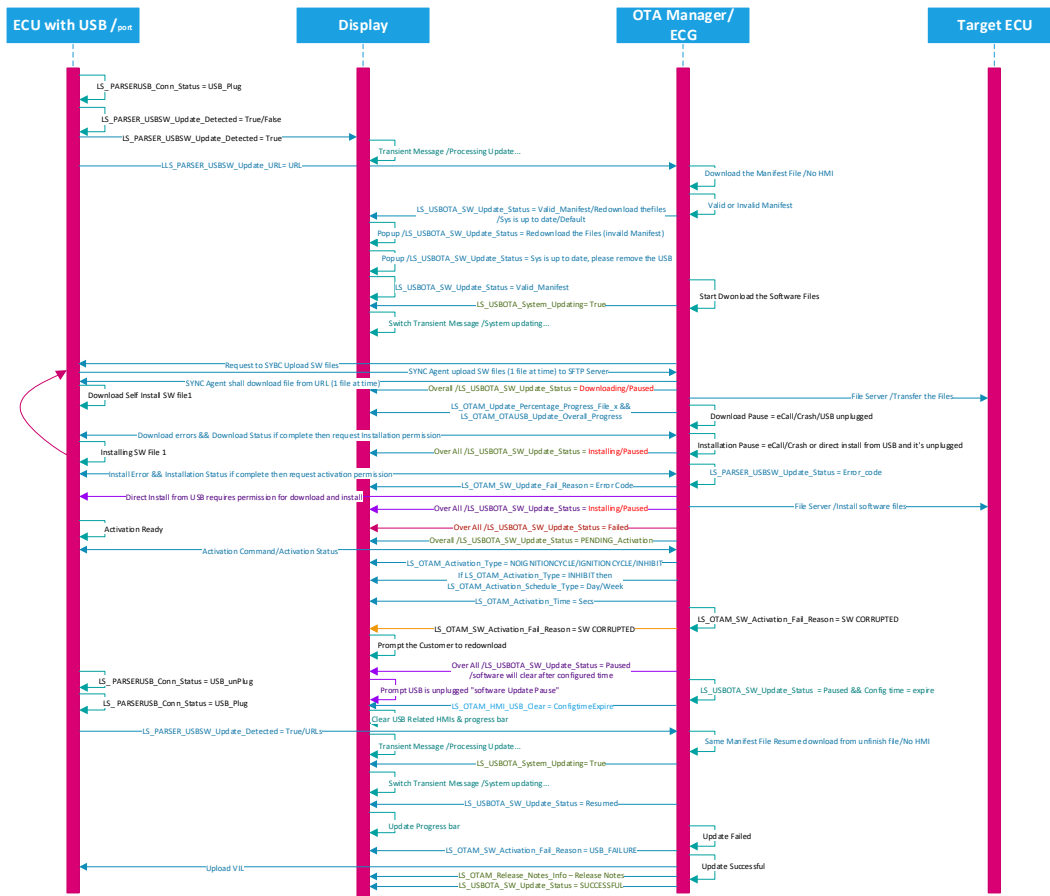


Figure 4: Context Diagram of HMI

5.1.3 Function Interfaces

5.1.3.1 Logical Inputs

Signal ID	Signal Name	Description
	LS_PARSERUSB_Conn_Status	
	LS_PARSER_USBSW_Update_Detected	



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

	LS_USBOTA_SW_Update_Status	Valid_Manifest/Redownload the files/Sys is up to date/Default If invalid Manifest, then prompt Re-download the Files If Sys is up to date, then prompt please remove the USB If Valid Manifest, then system updating message
	LS_USBOTA_SW_Update_Status	
	LS_OTAM_Update_Percentage_OverallProgress	
	LS_OTAM_SW_Update_Fail_Reason	
	LS_OTAM_Activation_Type	NOIGNITIONCYCLE/IGNITIONCYCLE/INHIBIT
	LS_OTAM_Activation_Schedule_Type	Day/Week
	LS_OTAM_Activation_Time	In seconds
	LS_OTAM_SW_Activation_Fail_Reason	

5.1.4 Function Modeling

Figure 5: HMI Function

5.1.5 Function Requirements

5.1.5.1 Requirements on HMI Controller

5.1.5.1.1 F-REQ-304789/B-###R_FNC_USB_070### HMI Update Progress

The Self Installer Manager HMI shall acknowledge when customer inserts USB contains OTA software update and provide the customer feedback that USB us detected valid OTA software packages.

If a USB update is for Self Installer Manager, then OTA manager shall self-install Manager to start update process.

Self-Installer Manager shall report software update progress to OTA manager. The OTA Manager module shall provide flags for HMI for USB software update.

If USB disconnected: - if the USB disconnect during the initialization and/or download process, the HMI shall prompt the User to reconnect the USB to proceed with the software update process. The system shall automatically resume with the USB Update process.

If a USB software update interpret current update (OTA or older USB), then the HMI progress bar shall reset to reflect the new software update process.

5.1.5.1.2 FUR-REQ-324923/A-###R_FNC_USB_071###Download Manifest Files

Software update agent shall download and transfer the manifest files to software update manager through Ethernet connection.

When Software Update Manager request to download the manifest file, then it shall set a flag to HMI "keep USB plugged in until software update is complete".

5.1.5.1.3 FUR-REQ-322742/A-###R_FNC_USB_072### USB Parser Validating Software Updates and HMI notification

After detecting USB device with software updates USB parser shall notify in vehicle HMI with initial feedback such as transient message "Processing Update..."

Initial feedback to the customer LS_PARSER_USBSW_Update_Detected = True

If USB is unplugged during initialization, then HMI shall not show any errors and clear the initial HMI.



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

5.1.5.1.4 FUR-REQ-324924/A-###R_FNC_USB_073###Software Package Corrupted

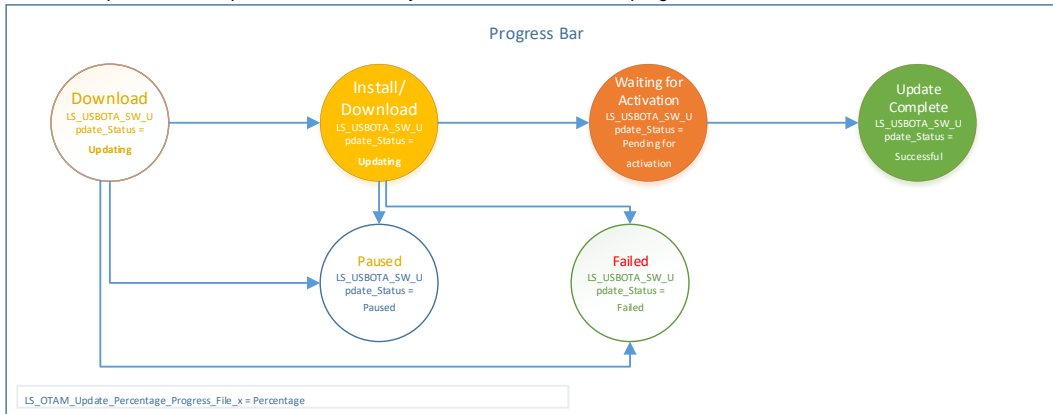
If any of the software file(s) are corrupted, then OTA Manager shall set flag **LS_OTAM_SW_Activation_Fail_Reason = SW CORRUPTED**; and HMI shall prompt the customer to download the software files and retry.

5.1.5.1.5 REQ-326577/A-###R_FNC_USB_074###USB Software Failed during Download/Transfer/Installation

If software update (download/transfer/installation) failed **LS_USBOTA_SW_Update_Status = Failed**, then HMI shall display that update was failed remove the USB device and re-download the software before continuing with software update.

5.1.5.1.6 FUR-REQ-324986/A-###R_FNC_USB_075### Progress Bar for USB Update

Progress bar shall be capable over all progress of the USB software update and number of files it's progressing.
If software update is incomplete or failed, then system shall reset the HMI progress bar.



Flow 8: Progress Bar for USB Software update

If system is downloading and/or installing the USB software **LS_USBOTA_SW_Update_Status = updating**, HMI screen shall show system is updating with overall progress bar and number of files it's progressing.

If USB software update is paused **LS_USBOTA_SW_Update_Status = Paused**, then HMI progress bar shall show update is paused or cleared (Ref to OTA Manager spec for more details).

If USB software update is pending for software activation **LS_USBOTA_SW_Update_Status = Pending for activation**, then progress bar shall show that system is waiting for software activation, such as ignition cycle or schedule time.

If USB software update is Successfully complete **LS_USBOTA_SW_Update_Status = Successful**, then HMI shall show update is complete remove the USB device and show release notes.

5.1.5.1.7 FUR-REQ-324901/A-###R_FNC_USB_076###HMI Prompt for "System Updating"

If manifest file is valid, then OTA Manager shall set a flag for HMI to display "system is updating".

LS_USBOTA_System_Updating = Valid Manifest

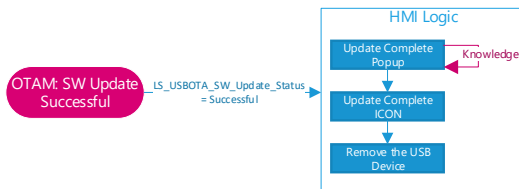
5.1.5.1.8 FUR-REQ-324918/A-###R_FNC_USB_077###"Check for Updates" Button in HMI during USB Update

If "Check for Updates" button is pressed and there is an update in progress through USB, then the HMI shall notify a window to inform the customer to retry after the USB is complete "Check for Updates" Button in HMI during USB Update



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

5.1.5.1.9 FUR-REQ-324987/A-###R_FNC_USB_078### Software Update was successful HMI flow



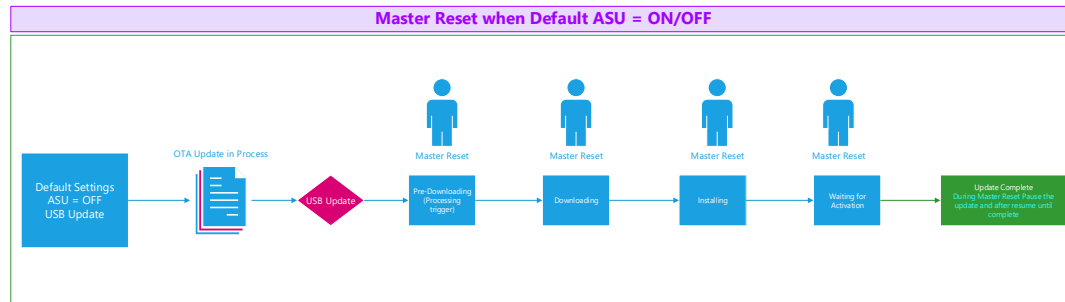
Flow 9: Sequence of HMIs After Software is Successful

5.1.5.2 Requirements on HMI Views

5.1.5.2.1 HMI View

N/A

5.1.5.2.2 Master Reset During USB Update



Flow 10: Master Reset during USB Software Update



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

6 Open Concerns

ID	Concern Description	e-Tracker / Reference	Responsible	Status	Solution
	Garmin Map Update	OTA Garmin Map date: SWUM is covering 100% update for the Garmin applications. Garman shall Manage MAP-OTA data USB Garmin Map date: USB shall contain multiple part numbers For USB Update Garmin shall contain all of the map data. For a FULL one-shot replacement of Garmin map data, the Garmin app CANNOT be running			
	non-Ford business Fleet	IVSURQMT-189		Backlog Item	Not for Job1

Table 5: Open Concerns



Function Specification (FncS) IVSU_Cloud_Function_USB_Updates

7 Revision History

Rev. (revision)	Date	Description	Approved by	Responsible
1.0.0	03/15/18	Initial version		
1.9.2	8/31/18	Erase and Replace		
		File download		
		Multiple USB Device Found with Software Update		
		USB Progress bar		
		Invalid Software found on USB, such as old software		
		USB Parser shall not send any errors (files are valid- start update or invalid-do nothing)		
		Added flows to clarify		