

**NETWORK MANAGEMENT SYSTEM  
DISTRIBUTION MANAGEMENT SYSTEM (DMS)  
v2.5**

**5.5.1.2 NMS(DMS).Manage Predicted Fault Locations**

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## Brief Description

<b>Business Process:</b>	<b>5.5.1.2. NMS(DMS).Manage Predicted Fault Locations</b>
<b>Process Type:</b>	<b>Sub Process</b>
<b>Parent Process:</b>	<b>5.5.1 NMS(DMS).Manage Network Faults</b>
<b>Sibling Processes:</b>	<b>5.5.3.1 NMS(OMS).Process Input and Create Unplanned Outage Event</b>

Faults occur on distribution networks every now and then, due to various abnormal circuit conditions, such as a tree falling on a wire or equipment failure. It is essential to know the location of the fault, so that, crew members can be routed effectively in a timely manner thus reducing the outage duration.

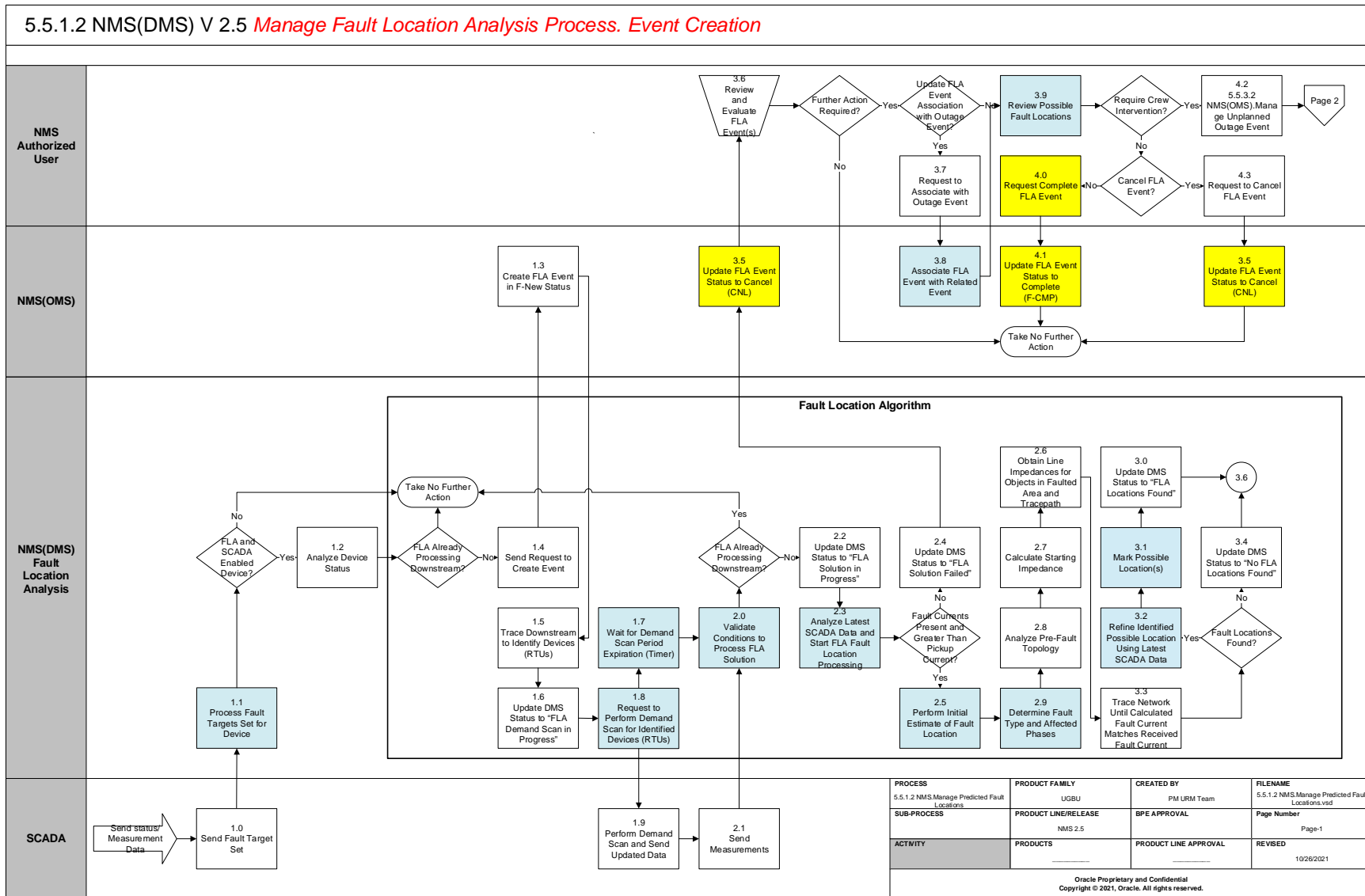
When a Fault occurs on a utility telemetered feeder, the first protective device upstream of the fault will open to clear the fault. If any fault recording equipment is located at the protective device, it will record the magnitude of the fault observed. This telemetry is monitored by a 3<sup>rd</sup> party SCADA system and is essential data for the Oracle NMS Fault Location Analysis (FLA) application. Once the data has been received by the SCADA system from the field, it is sent from the SCADA system to NMS via SCADA integration.

If proper telemetry is received from SCADA, NMS will initialize FLA processing. FLA will begin to use the fault current magnitude(s) recorded from the field device(s) and associated NMS impedance model to begin looking for possible fault locations on the feeder. Once locations are found, a fault event will be created in NMS. An NMS Authorized User can open the [FLA Tool](#) from the work agenda. [FLA Tool](#) shows the information related to the fault such as telemetry received and a tabular list of the possible fault locations. If NMS Authorized User believes, the possible locations suggested by FLA, look reasonable, they can begin dispatching crews to investigate the possible fault locations suggested by the FLA and determine the true location of the fault. Once the fault location is confirmed, NMS Authorized User can use 'Isolate and Restore' operation using the suggested switching (If licensed) to minimize the impact of the fault.

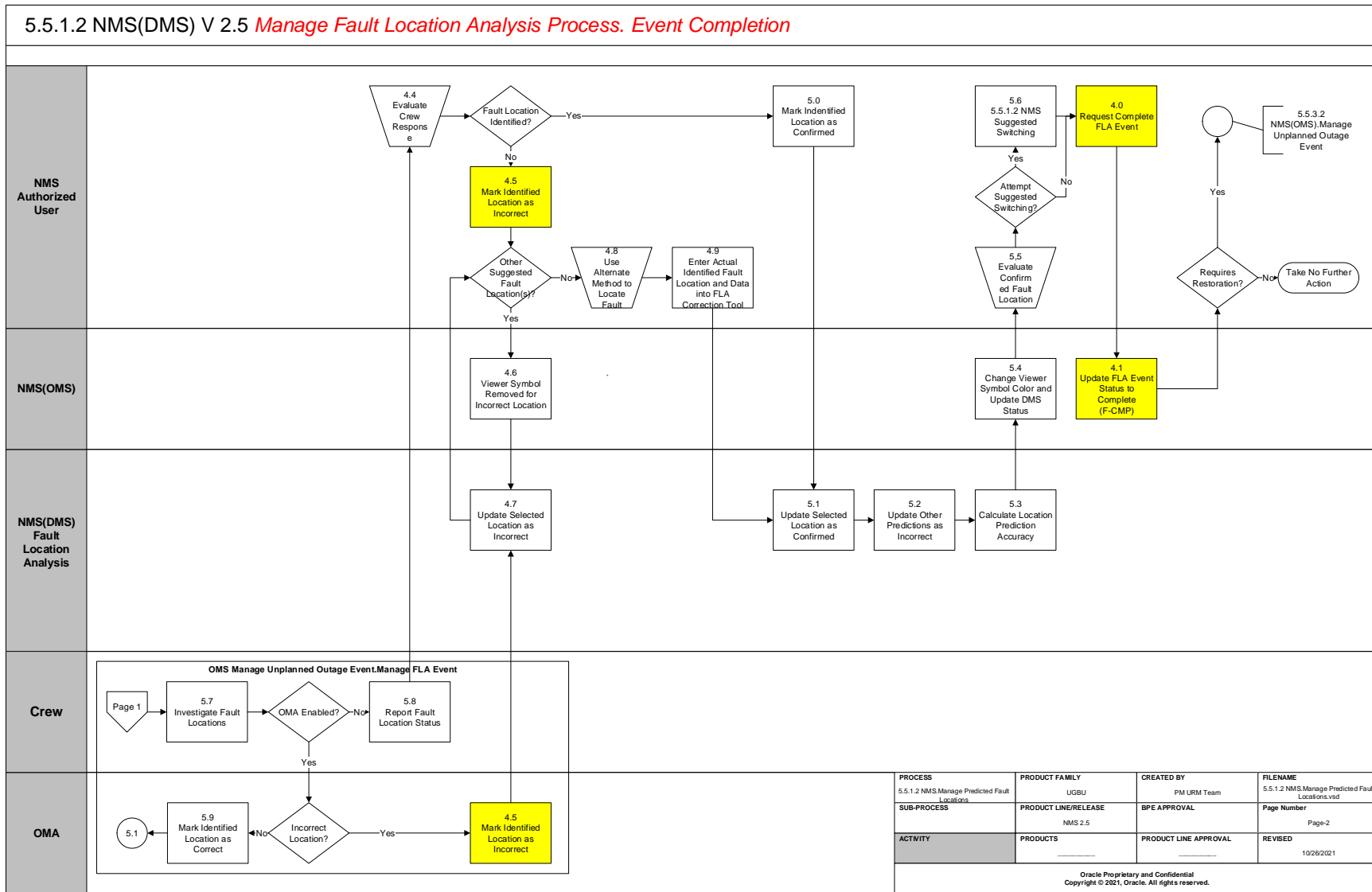
The primary actors for the Fault Location Analysis application process are as follows:

- NMS Authorized User: Monitors the work agenda, performs manual actions and routes Crew as and when necessary.
- Fault Location Analysis: FLA application works within Oracle Utilities NMS framework. It identifies the fault current, and based on it, calculates the fault impedance, thus suggesting the distance of the fault from the source.
- SCADA: SCADA System is a 3rd party application which is often integrated with NMS. SCADA is the primary method for receiving telemetry related to field devices. SCADA can also be configured to take in the control commands sent from NMS, execute them, and send feedback to NMS. FLA application receives fault current magnitude(s) and fault indicator(s) during a fault event from the SCADA system.
- OMS: Outage Management System (OMS) is an integral part of NMS. It is responsible for event management and crew management tasks.
- Crew: Maintenance crew is responsible for investigating and fixing the fault. They also report the status of the fault locations to the operator.
- OMA: Oracle Mobile Application (OMA) is a mobile tool which crew members can use to mark the correct/incorrect fault locations.

# Business Process Model Page 1



# Business Process Model Page 2



## Detail Business Process Model Description

### 1.0 Send Fault Target Set

**Actor/Role:** SCADA

**Description:** The 3<sup>rd</sup> Party Application SCADA sends a digital measurement to NMS that indicates a “Fault Target” has tripped at a field device. “Fault Target” measurement is the trigger for the FLA analysis as it implies that a fault has occurred below the device

### 1.1 Process Fault Targets Set for Device

**Actor/Role:** NMS(DMS)

**Description:** NMS receives and processes the “Fault Targets”. It helps FLA to determine the phases involved in the fault and also it expects to received the “Fault Currents” for the same phases.

**Task Customizable (Y)**

**Available Rule(s):**

Mechanism	Rule
SRS Rules	_PF_MEAS_FAULT_INDICATOR
SRS Rules	_PF_MEAS_FAULT_INDICATOR_A
SRS Rules	_PF_MEAS_FAULT_INDICATOR_B
SRS Rules	_PF_MEAS_FAULT_INDICATOR_C

**Configuration required (Y)**

**Entities to Configure:**

SRS Rules, SCADA Adapter

### 1.2 Analyze Device Status

**Actor/Role:** NMS(DMS)

**Description:** Analyze the status of the fault reporting device, did the device trip to clear the fault or is it still closed.

### 1.3 Create FLA Event in F-New Status

**Actor/Role:** NMS(OMS)

**Description:** The fault event will be created within NMS. The event type that will be created is an “F-NEW”, this event type does not relate to an outage and is reserved purely for FLA events.

**Group: Fault Location Algorithm**

**1.4 Send Request to Create Event**

**Actor/Role:** NMS(DMS)

**Description:** Once FLA receives the SCADA measurements and determines that it is a valid new event which should be processed, it sends a request to create an event that can be viewed in the Work Agenda.

**Group: Fault Location Algorithm**

**1.5 Trace Downstream to Identify Devices (RTUs)**

**Actor/Role:** NMS(DMS)

**Description:** A trace is performed downstream of the device that reports the fault, to identify all SCADA telemetered devices and determine the RTU id for each. These RTU ids are used in the demand scan request that is sent to SCADA.

**Group: Fault Location Algorithm**

**1.6 Update DMS Status to “FLA Demand Scan in Progress”**

**Actor/Role:** NMS(DMS)

**Description:** The DMS Status in the Work Agenda is updated to “FLA Demand Scan in Progress” to indicate the progress to the operator.

**Group: Fault Location Algorithm**

**1.7 Wait for Demand Scan Period Expiration (Timer)**

**Actor/Role:** NMS(DMS)

**Description:** After the demand scan request is sent, NMS initiates a demand scan timer. This timer allows the SCADA system to receive the demand scan request and scan the provided list of RTUs and then send the information back to NMS. The timer is an asynchronous timer and there is no handshake between NMS and the SCADA system that indicates the update measurements are received. Once NMS sends the request out, the timer starts. FLA continues its processing after timer expires, regardless of whether updates were received or not. When configuring this timer, the project should consider the latency that exists on the SCADA system from different device types and how long it takes to receive measurements from various devices. The timer should be configured based on the worst latency that exists on the SCADA system.

**Task Customizable (Y)**

**Available Rule(s):**

Mechanism	Rule
SRS Rules	FLA_DEMAND_SCAN_THRESHOLD

**Configuration required (Y)**

**Entities to Configure:**

SRS Rules
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**Group: Fault Location Algorithm**

**1.8 Request to Perform Demand Scan for Identified Devices (RTUs)**

**Actor/Role:** NMS(DMS)

**Description:** A demand scan request is sent out to the SCADA system for the RTU ids obtained in 1.5. A SCADA adapter configuration is needed to perform this task.

**Configuration required (Y) Entities to Configure:**

**1.9 Perform Demand Scan and Send Updated Data**

**Actor/Role:** SCADA

**Description:** The SCADA system receives the request for demand scan from NMS with the list of RTUs that need to be scanned. The SCADA system executes the scan and sends the latest data from the field, back to NMS.

**Group: Fault Location Algorithm**

**2.0 Validate Conditions to Process FLA Solution**

**Actor/Role:** NMS(DMS)

**Description:** Validate whether feeder conditions are still ok to continue processing the FLA event after demand scan timer expires.

<b>Task Customizable (Y)</b>	<b>Available Rule(s):</b>	<b>Mechanism</b>	<b>Rule</b>
		SRS Rules	FLA_IGNORE_PHASES

**Configuration required (Y) Entities to Configure:**

**2.1 Send Measurements**

**Actor/Role:** SCADA

**Description:** After scanning the devices that were sent in the demand scan request, the SCADA system sends the updated measurements back to NMS.

**Group: Fault Location Algorithm**

**2.2 Update DMS Status to “FLA Solution in Progress”**

**Actor/Role:** NMS(DMS)

**Description:** The DMS Status in the Work Agenda is updated to “FLA Solution in Progress” to indicate the progress to the operator.

**Group: Fault Location Algorithm**

**2.3 Analyze Latest SCADA data and Start FLA Fault Location Processing**

**Actor/Role:** NMS(DMS)

**Description:** Analyze the latest SCADA data received after the demand scan for the fault location processing. FLA checks to ensure that fault currents received are greater than the FLA pickup scale factor times fault reporting device rating. This ensures, only fault current magnitudes are used in the analysis. Check once more that FLA is not processing downstream and then begin actual Fault Location Processing.

<b>Task Customizable (Y)</b>	<b>Available Rule(s):</b>	<b>Mechanism</b>	<b>Rule</b>
		SRS Rules	FLA_PICKUP_SCALE_FACTOR

<b>Configuration required (Y)</b>	<b>Entities to Configure:</b>	SRS Rules
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**Group: Fault Location Algorithm**

**2.4 Update DMS Status to “FLA Solution Failed”**

**Actor/Role:** NMS(DMS)

**Description:** If FLA solution fails for some reason, the DMS Status in the Work Agenda is updated to “FLA Solution Failed”.

**Group: Fault Location Algorithm**

**2.5 Perform Initial Estimate of Fault Location**

**Actor/Role:** NMS(DMS)

**Description:** After validating the SCADA data begin fault location processing with an initial estimate of the fault location(s).

<b>Task Customizable (Y)</b>	<b>Available Rule(s):</b>	<b>Mechanism</b>	<b>Rule</b>
		SRS Rules	FLA_ALGORITHM_MULTIPLIER

<b>Configuration required (Y)</b>	<b>Entities to Configure:</b>	SRS Rules
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**Group: Fault Location Algorithm**

**2.6 Obtain Line Impedances for Objects in Faulted Area and Tracepath**

**Actor/Role:** NMS(DMS)

**Description:** Obtain line impedances and cable impedances for the objects in the faulted area and trace path to be used in the fault location processing.

**Group: Fault Location Algorithm**

**2.7 Calculate Starting Impedance**

**Actor/Role:** NMS(DMS)

**Description:** Run a short circuit analysis at initially estimated fault location area as determined in 2.5. This will give FLA an initial starting impedance at the estimated fault location(s).

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	_PF_MEAS_FAULT_KV_A
SRS Rules	_PF_MEAS_FAULT_KV_B
SRS Rules	_PF_MEAS_FAULT_KV_C

**Configuration required (Y)**      **Entities to Configure:**

SRS Rules

**Group: Fault Location Algorithm**

**2.8 Analyze Pre-Fault Topology**

**Actor/Role:** NMS(DMS)

**Description:** FLA uses the topology that was present “pre-fault” in the analysis, since protective devices can operate to clear faults the pre-fault topology and post-fault topology may be different.

**Group: Fault Location Algorithm**

**2.9 Determine Fault Type and Affected Phases**

**Actor/Role:** NMS(DMS)

**Description:** Using the received SCADA data, determine the fault type of affected phases. For example, if only phase A has a valid fault current magnitude, FLA will process this fault as phase A to ground fault.

**Task Customizable (Y) Available Rule(s):**

Mechanism	Rule
SRS Rules	_PF_MEAS_FAULT_CURRENT_A
SRS Rules	_PF_MEAS_FAULT_CURRENT_B
SRS Rules	_PF_MEAS_FAULT_CURRENT_C

**Configuration required (Y) Entities to Configure:**

SRS Rules

**Group: Fault Location Algorithm**

**3.0 Update DMS Status to “FLA Locations Found”**

**Actor/Role:** NMS(DMS)

**Description:** Once FLA completes its processing and determines the fault location(s), the DMS Status in the Work Agenda is updated to “FLA Locations Found”.

**Group: Fault Location Algorithm**

**3.1 Mark Possible Location(s)**

**Actor/Role:** NMS(DMS)

**Description:** Once FLA finds the possible fault locations; they are marked in NMS viewer with a symbol. Project specific trouble codes should be configured and mapped in srs\_touble\_codes database table. Then, these trouble codes should be configured in SRS rules as given below -

**Task Customizable (Y)**

Mechanism	Rule
SRS Rules	faultIncorrectTcode
SRS Rules	faultProbableTcode
SRS Rules	faultConfirmedTcode
SRS Rules	faultUndeterminedTcode

**Configuration required (N) Entities to Configure:**

Symbology for Location Symbol, Trouble Codes

**Note:** Projects will need to ensure the SRS rules that represent the various states of fault predictions match valid entries in database table SRS\_TROUBLE\_CODES. If entries to do not yet exist in the trouble code table they should be added using product configuration as a template to get started. This will likely result in a new category of trouble codes needing to be added to the table as customers will not want the FLA specific trouble codes to be displayed on the “Web Call Entry” user interface and by using a new category of trouble codes they can be removed from the user interface such that operators cannot select the FLA specific codes. Each digit within the SRS rule represents a trouble code category and the value represents the option within that category. So as an example if the first digit were five it would represent the SRS trouble code with a “GROUP\_NUM” of 1 since it’s the first digit within the string of digits and the value would represent a “CODE\_NUM” of 5.

**Group: Fault Location Algorithm**

**3.2 Refine Identified Possible Location Using Latest SCADA Data**

**Actor/Role:** NMS(DMS)

**Description:** Using fault indicators trips, that may have occurred on the feeder, FLA refines the probable fault locations. For example, if probable fault location is located below an unset fault indicator, the probable location is removed.

Note: A “fault indicator” is simply a digital measurement that indicates a fault has occurred downstream of the device that sent the measurement.

**Task Customizable (Y) Available Rule(s):**

Mechanism	Rule
SRS Rules	_PF_MEAS_FAULT_INDICATOR
SRS Rules	_PF_MEAS_FAULT_INDICATOR_A
SRS Rules	_PF_MEAS_FAULT_INDICATOR_B
SRS Rules	_PF_MEAS_FAULT_INDICATOR_C

**Configuration required (Y) Entities to Configure:**

SRS Rules

**Group: Fault Location Algorithm**

**3.3 Trace Network Until Calculated Fault Current Matches Received Fault Current**

**Actor/Role:** NMS(DMS)

**Description:** Starting at the location where short circuit analysis was conducted FLA begins tracing downstream until the fault current received from SCADA matches the fault current calculated based on the network impedance model.

**Task Customizable (Y) Available Rule(s):**

Mechanism	Rule
SRS Rules	FLA_TOLERANCE_PERCENTAGE

**Configuration required (Y) Entities to Configure:**

SRS-Rules

**Group: Fault Location Algorithm**

**3.4 Update DMS Status to “No FLA Locations Found”**

**Actor/Role:** NMS(DMS)

**Description:** Once FLA completes its processing but could not find any possible fault locations, the DMS Status in the Work Agenda is updated to “No FLA Locations Found”.

### [3.5 Update FLA Event Status to Cancel \(CNL\)](#)

**Actor/Role:** NMS(OMS)

**Description:** After the request has been sent to cancel the event by NMS Authorized User, NMS will transition the event status in the Work Agenda to CNL.

### [3.6 Review and Evaluate FLA Event\(s\)](#)

**Actor/Role:** NMS Authorized User

**Description:** An NMS Authorized User can view the fault event in the Work Agenda and access the [FLA Tool](#) to review the data and results from the FLA Analysis.

### [3.7 Request to Associate with Outage Event](#)

**Actor/Role:** NMS Authorized User

**Description:** An NMS user can manually associate the Fault Event to an outage event if an outage occurs. This is a good practice for post outage analysis. The fault event created by the FLA does not contain outage information, a separate event for the outage will be created as well. For example, a tree falls on a wire; this trips the breaker and creates a sustained outage (RDO). In this scenario, an S-NEW outage event is created alongside an F-NEW event. The S-NEW event would be a normal outage event with information related to customers out and the F-NEW event would contain specific information related to the fault such as fault magnitudes.

### [3.8 Associate FLA Event with Related Event](#)

**Actor/Role:** NMS(OMS)

**Description:** Perform the actual association between the outage event and fault event within the Work Agenda.

**Task Customizable (Y)**      **Available Rule(s):**

Mechanism	Rule
SRS Rules	outageFLAAssociationThreshold

**Configuration required (Y)**      **Entities to Configure:**

Event Association SRS-Rules
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### [3.9 Review Possible Location](#)

**Actor/Role:** NMS Authorized User

**Description:** If NMS user chooses to open the [Fault Location Analysis tool](#), pertinent information can be viewed and analyzed. Information displayed will consist of probable fault locations and SCADA telemetry received on the feeder pertaining to the fault. An NMS Authorized User should prioritize the probable locations if more than one exists. Their knowledge of the system protection and system design should be able to help

with this prioritization. Also, additional information from the outage event may be used for the prioritization. For example, if two locations are predicted, both on fused lateral taps, but one lateral had outage calls that would be where you would want to investigate first.

#### **4.0 Request Complete FLA Event**

**Actor/Role:** NMS Authorized User

**Description:** If NMS Authorized User wish to complete the fault event, a request to complete the event can be sent.

#### **4.1 Update FLA Event Status to Complete(F-CMP)**

**Actor/Role:** NMS(OMS)

**Description:** After a request is sent to complete the event by the NMS Authorized User, NMS transitions the event status in the Work Agenda to F-CMP.

#### **4.2 5.5.3.2 NMS(OMS).Manage Unplanned Outage Event**

**Actor/Role:** NMS Authorized User

**Description:** An operator can process the unplanned outage event by dispatching the crew to the predicted fault locations. Crew in turn can investigate the predicted locations and confirm the correct fault location in the field.

#### **4.3 Request to Cancel FLA Event**

**Actor/Role:** NMS Authorized User

**Description:** If the NMS Authorized User does not wish to work on the fault event or determines the results to be inaccurate, a request to cancel the event can be sent.

#### **4.4 Evaluate Crew Response**

**Actor/Role:** NMS Authorized User

**Description:** The NMS Authorized User receives the report of the probable location either from the crew via radio or from OMA. This determines whether the fault is found, or the next predicted location needs to be investigated.

#### **4.5 Mark Identified Location as Incorrect**

**Actor/Role:** NMS Authorized User/OMA

**Description:** If a fault is not found at a predicted location by the crew, NMS Authorized User marks that location as incorrect within the FLA user interface. If OMA is available to the crew, they can mark the location incorrect in OMA by themselves. This will automatically update the NMS FLA user interface.

#### **4.6 Viewer Symbol Removed for Incorrect Location**

**Actor/Role:** NMS(OMS)

**Description:** NMS removes the incorrect probable fault location from the viewer.

#### **4.7 Updated Selected Location as Incorrect**

**Actor/Role:** NMS(DMS)

**Description:** The selected location is marked incorrect in the FLA user interface.

#### **4.8 Use Alternate Method to Locate Fault**

**Actor/Role:** NMS Authorized User

**Description:** If all probable locations generated by Fault Location Analysis are found incorrect, an alternate method should be used. for example, patrolling the feeder looking for the fault.

#### **4.9 Enter Actual Identified Fault Location and Data into FLA Correction Tool**

**Actor/Role:** NMS Authorized User

**Description:** Once the fault is located using an alternate method the actual information related to the fault can be entered using the [FLA correction tool](#). This allows the utility to accurately keep track of faults that have occurred on the system. This also provides a record where utility can go back to analyze the worst performing feeders in terms of accuracy. So that actions can be taken to improve the FLA predictions.

#### **5.0 Mark Identified Location as Confirmed**

**Actor/Role:** NMS Authorized User

**Description:** Once crew confirms the fault location, NMS Authorized User marks that location as confirmed within the FLA user interface.

#### **5.1 Update Selected Location as Confirmed**

**Actor/Role:** NMS(DMS)

**Description:** Fault Location Analysis registers the selected location as confirmed



## **5.2 Update Other Predictions as Incorrect**

**Actor/Role:** NMS(DMS)

**Description:** Fault Location Analysis registers all other locations as incorrect.

## **5.3 Calculate Location Prediction Accuracy**

**Actor/Role:** NMS(DMS)

**Description:** If crew reports the fault location near a predicted fault location, Fault Location Analysis calculates location of the actual fault location as a percentage of its distance from the nearest predicted fault location.

## **5.4 Change Viewer Symbol Color and Update DMS Status**

**Actor/Role:** NMS(OMS)

**Description:** The viewer symbol transitions from yellow to orange to signify it is not a probable fault location but a confirmed fault location. DMS Status in Work Agenda is also updated with the result of the location prediction accuracy calculation.

**Task Customizable (Y)**

**Configuration required (N) Entities to Configure:**

Symbology for Fault Location
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## **5.5 Evaluate Confirmed Fault Locations**

**Actor/Role:** NMS Authorized User

**Description:** Once the fault is confirmed, the operator evaluates his options to clear the fault.

## **5.6 5.5.1.2 NMS Suggested Switching**

**Actor/Role:** NMS Authorized User

**Description:** Once the fault location is confirmed, the NMS user may use 'Isolate and Restore' function from Suggested Switching. This is an optional step and requires the Suggested Switching license.

**Group: OMS Manage Unplanned Outage Event.Manage FLA Event**

## **5.7 Investigate Fault Locations**

**Actor/Role:** Crew

**Description:** When a crew reaches to a probable fault location, it performs the investigation for the possible fault

**Group: OMS Manage Unplanned Outage Event.Manage FLA Event**

**5.8 Report Fault Location Status**

**Actor/Role:** Crew

**Description:** After investigating a possible fault location, crew reports the status of the location back to the operator as either an incorrect fault location or a confirmed fault location.

**Group: OMS Manage Unplanned Outage Event.Manage FLA Event**

**5.9 Mark Identified Location as Correct**

**Actor/Role:** OMA

**Description:** If OMA is available to the crew, they can mark a given possible fault location as a correct location in OMA, once they find the fault. This automatically updates the FLA user interface in NMS.

# Document Control

## Change Record

Date	Author	Version	Change Reference
03/20/2014	Srinivas Kanteti	1	Initial Version
07/20/2021	Saurabh Gupta	2.5.0.1	Revised Version
08/04/2021	Andrew Neddermeyer	2.5.0.1	Made changes to section 3.1 to document config
08/05/2021	Palak Jain	2.5.0.1	Reviewed
08/05/2021	Ian Hoogendam	2.5.0.1	Reviewed
08/17/2021	Galina Polonsky		Reviewed, Approved

# Attachments

## FLA Tool

Event Details
12568 : BR2411 x

File Actions Help

EVENT #	12568	# EMER.	0	START DATE	07/14/21 11:10	DEVICE	BR2411	Scada Rack Air Circuit Breaker
PHASES OUT		# MED.	0	EST RESTORE DATE	##/##/## ##:##	SHEET #		
# CALLS	2	# KEY	0	RESTORE DATE	07/21/21 11:16	CLUES	Possible Fault	
CUSTOMERS OUT	0	# SENS.	0	EST TIME TO REPAIR	##:##	ZONE	OPAL Stark Lake Lake Sub 2411S	

Job Actions	Completion Actions	Equipment Failure	Damage Assessments	Event Log	Steps	<b>Fault Location Analysis</b>	Attachments
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File Actions

**SCADA Measurements**

DEVICE	STATUS	FAULT I...	QUA...	AMPS (A)	AMPS (B)	AMPS (C)	KV (A)	KV (B)	KV (C)
BR2411	Tripped	Y/Y/Y/N	Ok	2218	2218	2218	0	0	0
S4508	Closed	Y/Y/Y/N	Ok	2218	2218	2218	0	0	0
S4510	Closed	Y/Y/Y/N	Ok	0	0	0	0	0	0
S3122	Closed	Y/Y/Y/N	Ok	0	0	0	0	0	0
S3120	Closed	N/N/N/N	Ok	0	0	0	0	0	0

**FLA Messages**

DEVICE	DATE	IS ALARM	MESSAGE DESCRIPTION
OH3P-2291497-463139-229097...	07/14/21 11:11:20.884	N	2050: Skipping location since it is upstream of a Fault Indicator on S4510 (377.1000)
OH3P-2286908-466467-228626...	07/14/21 11:11:20.916	N	2080: Moved location upstream to OH3P-2289366-466413-2289782-466410 (406.3215) due to unset Fault Indicat...
OH3P-2288662-467665-228860...	07/14/21 11:11:20.931	N	2080: Moved location upstream to OH3P-2289366-466413-2289782-466410 (406.3215) due to unset Fault Indicat...
OH3P-2290500-469097-229065...	07/14/21 11:11:20.960	N	2080: Moved location upstream to OH3P-2290002-466641-2289782-466410 (406.3217) due to unset Fault Indicat...
BR2411	07/14/21 11:11:20.970	Y	0030: FLA solution found

**Possible Fault Locations**

STATUS	FAULT TYPE	FAULT DEVICE	PHASES	LOCATION	TOTAL DIS...	COORDINATES
Possible Fault	Phase ABC to Grou...	OH3P-2289366-46641...	ABC	0 ft to S3120	29864 ft	40.941, -81.339
Possible Fault	Phase ABC to Grou...	OH3P-2290002-46664...	ABC	0 ft to S3121	29864 ft	40.942, -81.336

### FLA Correction Tool

### Summary of FLA Messages

Summary of FLA Messages v NMS 2.5.0.1		
Message Code	Message String	URM Box#
0000	FLA demand scan request for event [\$EVENT_INDEX]	1.8
0010	FLA solution started for event [\$EVENT_INDEX]	2.3
0020	Fault predicted for event [\$EVENT_INDEX]	3.1
0030	FLA solution found	3.1
0040	FLA no solution found	3.4
0041	FLA no solution found	1.9
0050	FLA solution failed	2.4
0060	A downstream device also reported the fault, FLA will run from there	2.0
1010	Could not determine fault type - bad fault information	2.9
1020	Location estimation failed with error code [\$VAL1]	3.3
1030	FLA is operating in ignore phase mode	1.8
2010	No fault current measurements on device	2.3
2020	Fault currents Less than relay pickup currents (\$VAL1)	Fault Currents Present and Greater Than Pickup Current?

2030	Some fault currents are missing on device; hence aborting FLA solution	2.3
2040	Fault Targets and Fault Currents are inconsistent on device; ignoring stale Fault Currents	2.3
2050	Skipping location since it is upstream of a Fault Indicator on \$VAL1	3.2
2060	Skipping location because it is downstream from prediction on \$VAL1	3.2
2070	Skipping location downstream of \$VAL1 as Fault Indicator is not enabled	3.2
2080	Moved location upstream to \$VAL2 due to unset Fault Indicator on \$VAL1	3.2
2090	Fault current too high	3.1
2095	High impedance fault	3.1