

CONTROLLERS SOFTWARE AND HARDWARE

EMPOWER: 2023 Channel Partner Summit

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DISCUSSION POINTS

- Software
 - Improved Processes for development
 - Current projected development for software
 - 2023 release development
 - 3.4.0 new features
- Hardware
 - Proposed Dev Path
 - FLeX
 - EB3 / EB4

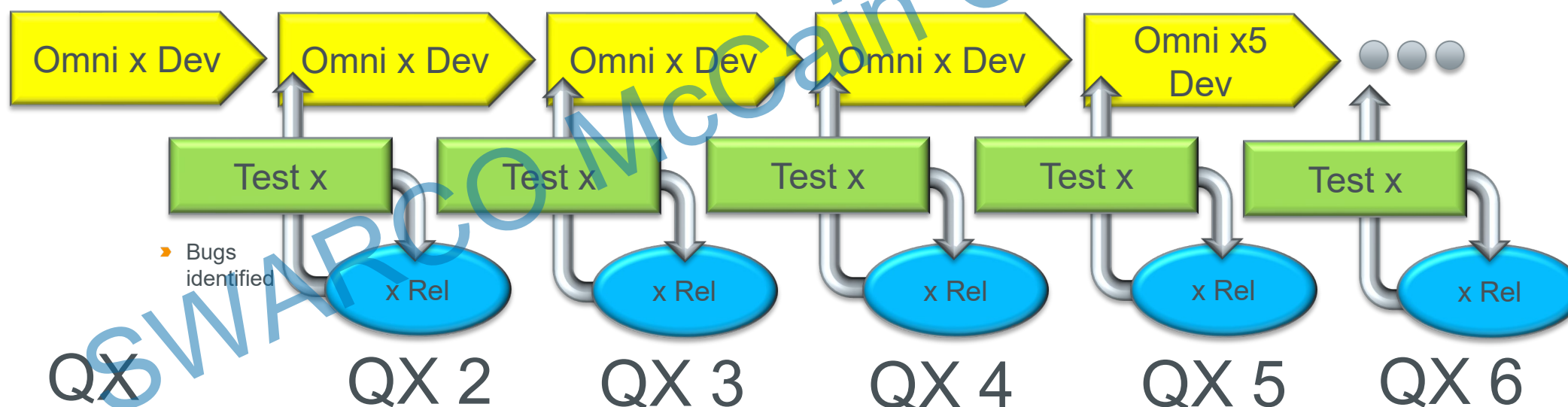
SOFTWARE

MATT ZINN

OMNI DEVELOPMENT GOAL

We will be targeting a release candidate every Quarter (example below)
One Quarter of Development One Quarter of testing before release for...

- Improving on features and functionality
- Improving quality and reduction of bugs on each release.
- Hot fixes which may be required but this will help reduce the need.



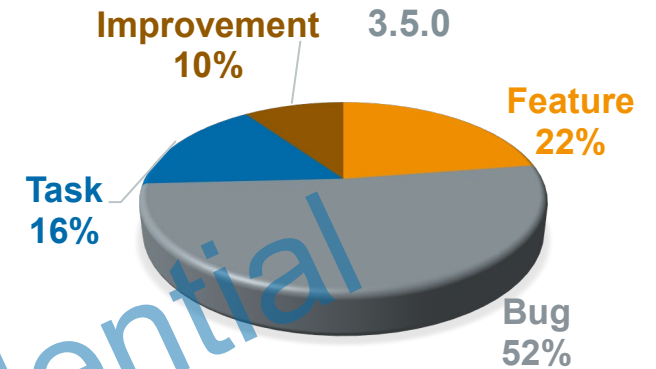
PROJECTED SOFTWARE ROADMAP

Engine Board
Development

	Omni 3.3.0	last release	Next Release	Future 1	Future 2	Future 3
EB6 (FLeX4)						
EB5 (SGC / FLeX2)						
EB4 (eX2, FLeX, LX+)						
EB3 (eX2, FLeX, 1C)				EB3 Discontinued support		
EB2 (eX, ATC)				EB2 Discontinued support		

	 ▪Foothills protocol complete ▪Web UI ▪Capture ▪BSP fixes ▪16 Preempts ▪.MCB vs .GZ ▪Multiple SPaT destinations Released Jan 2022	 ▪Coord / SCP fixes, harmonizing ▪ Enhancements ▪ Prep for Future development ▪ Key Features ▪OTA start ▪Red Light Protect Due 6/1/2022 - Released 10/30/22	 ▪Coord / SCP fixes, harmonizing ▪ 2033/233 features added to Omni to Transition customers ▪ Bug fixes from 3.4.0 ▪4.X.X will be designated for EB4 or less being supported - Q3 2023	 ▪Licensing Controller ▪OTA – Omni ▪NTCIP 3 (significant) ▪Coord / SCP / integrate TPRG with UI (significant) ▪SNMP 3 (start) ▪API TBD ▪Communications ▪MyCity Integration ▪SPaT J2735 development (CV) - Q1-Q2 2024	 ▪Security ▪SNMP 3 completed ▪NTCIP 3 completed ▪OTA - OS ▪Enhancements ▪Bug Fixes Q1 - 2025	 ▪TBD ▪Cyber Security ▪Enhancements ▪Bug Fixes ▪AI/ML
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NEXT RELEASE



- Improvements on the installer
- Continued efforts on Coordination
 - Actuated Coord can use Fixed or Floating Force
 - Permit and Omit strategies
 - TSP Adjustments
 - Elapsed Timers
- Allow NACT to come on with early return of green
- TSP Coord Mode Adjustment
- Red Revert used to serve No backup phases
- I/O mapping issues in 3.3.0 resolved
- TSP adjustments for all rings
- FYA remaining disabled by TOD (MODOT)
- Phase Option Set 2 not working (MODOT)
- Cycle and Coord fault with Max Recall
 - Skipping phase 5 causes Cycle Fault
- TSP not triggering Omni alarm bit
- Dynamic Max front panel reporting
- TSP not calling actuated overlap as expected
- Work on the Web VC to reduce 502 errors
- Behind the scenes improvements on OTA updates (For future release)
- Behind the scenes work on Capture file menus and MCB editors.

EOY'23 PROPOSED RELEASE

- Omni Installer Improvements for EB4
- Mode G FYA as default
- New Status objects (Actual cycle length)
- Some 233 / 2033 feature migration
- Alternate DB configurations
- Adding elapsed as Ring Status Objects
- TOD actions from 128 to 250
- Improved Coord Validation checks
- Enhanced Validity check in Omni

- Ability to switch sets on the fly
- SYSLOG error on HiRes log at line 83
- DynMax is resetting to upper limit when side street gaps
- Continued work on OTA
- Work in background in MCB and Capture



OMNI 3.4.0 RELEASE

Red Light Protection

- Red Light Protect
 - Protects the Intersection against a red light runner
 - Uses any detection that can predict ETAs or intrusion of a vehicle into the intersection during a red light.
 - Can't use any detector that is used as a **Call Passage or Added Init**
 - More Functionality than other manufacturers
 - Allows for multiple triggers
 - Allows for headway or activation limits
 - Can assign multiple detectors per phase
 - Simple to set up.
 - Activations Logged in controller.

```
2          PHASES

1. PHASE TIMINGS
2. PHASE OPTIONS
3. PHASE SEQUENCES
4. PHASE ENABLE AND RINGS
5. PHASE CONCURRENCY
6. RED LIGHT PROTECTION SETTINGS

y=YES n=NO End=NEXT
```

```
2.6  RED LIGHT PROTECTION SETTINGS

1. RED LIGHT PROTECTION CONSTANTS
2. RED LIGHT PROTECTION PHASE TIMINGS
3. RED LIGHT PROTECTION DETECTORS

y=YES n=NO End=NEXT
```

```
2.6.1  RLP CONSTANTS

RLP ACT / CYCLE  0
RLP HEADWAY (MIN) 0

y=YES n=NO End=NEXT
```

```
2.6.2  RLP PHASE TIMINGS, SET 1  R

PHASE#  1  2  3  4  5  6  7  8
RLPT/10  0  0  0  0  0  0  0  0
RLPA      0  0  0  0  0  0  0  0

y=YES n=NO End=NEXT
```

```
2.6.3  RLP DETECTOR SET 1  R

DET#  1  2  3  4  5  6  7  8
RLP PH 0  0  0  0  0  0  0  0

y=YES n=NO End=NEXT
```

```
<DB EDITING MODE ACTIVE - PRESS ENT> DR
DETECTOR#  1  2  3  4
CALL PHASE  1  2  2  2
SWITCH PHASE  0  0  0  0
CALL        NO  YES  YES  YES
PASSAGE     NO  YES  YES  YES
ADDED INIT  NO  YES  YES  YES
QUEUE       NO  NO   NO   NO

y=YES n=NO End=NEXT
```

WHY RED-LIGHT RUNNING PROTECTION

Problem Statement*

1. 42,060 lives were lost in 2020 due to traffic accidents
2. 846 lives were lost because of Red-Light Running in 2019
3. 143,000 were injured
4. 1 in 3 know someone killed in a red-light running crash
5. Between 2008 – 2019 9,227 people died in RLR crashes averaging about 770 per year.
6. Over ½ are pedestrians, bicyclists or non driving passengers
7. 86% of AAA's 2019 surveyed drivers say it is unacceptable to go through red-lights



Swarco McCain Solution

1. Provide a safety feature that creates a larger buffer than standard programming between conflicting directions when a red-light runner is detected.
2. Discourage bad behavior by only changing the red clearance timing, thus still making Red Light Running an illegal moving violation.
3. Protect the intersection, road users, and vulnerable users (peds and bikes) from the driver, not necessarily to solely protect the driver.
4. Use existing detection technology to determine when a potential red-light runner is approaching the intersection and be detector agnostic.
5. Be accurate but lean toward the side of safety and provide for a margin of error.

* sources: 1) NCSR, 2&3) IIHS, 4) USDOT, 5) NHTSA, 6&7) AAA

RED LIGHT RUNNING PROTECTION (RLP)

```
RG1 2G RG2 6G Thu Feb-03-2022 14:16:54
GREEN GREEN 1234567890ABCDEF STDBY
REST REST O/N O O PAT254
VEH R R CYC
PED OFF
OVL MCT
FREE COMMD POV LCT
SP FO H/O PRE
```

2 PHASES

1. PHASE TIMINGS
2. PHASE OPTIONS
3. PHASE SEQUENCES
4. PHASE ENABLE AND RINGS
5. PHASE CONCURRENCY
6. RED LIGHT PROTECTION SETTINGS

y=YES n=NO End=NEXT

Omni's solution for Red-Light Running Protection is to:

Protect the intersection from a Red Light Runner...

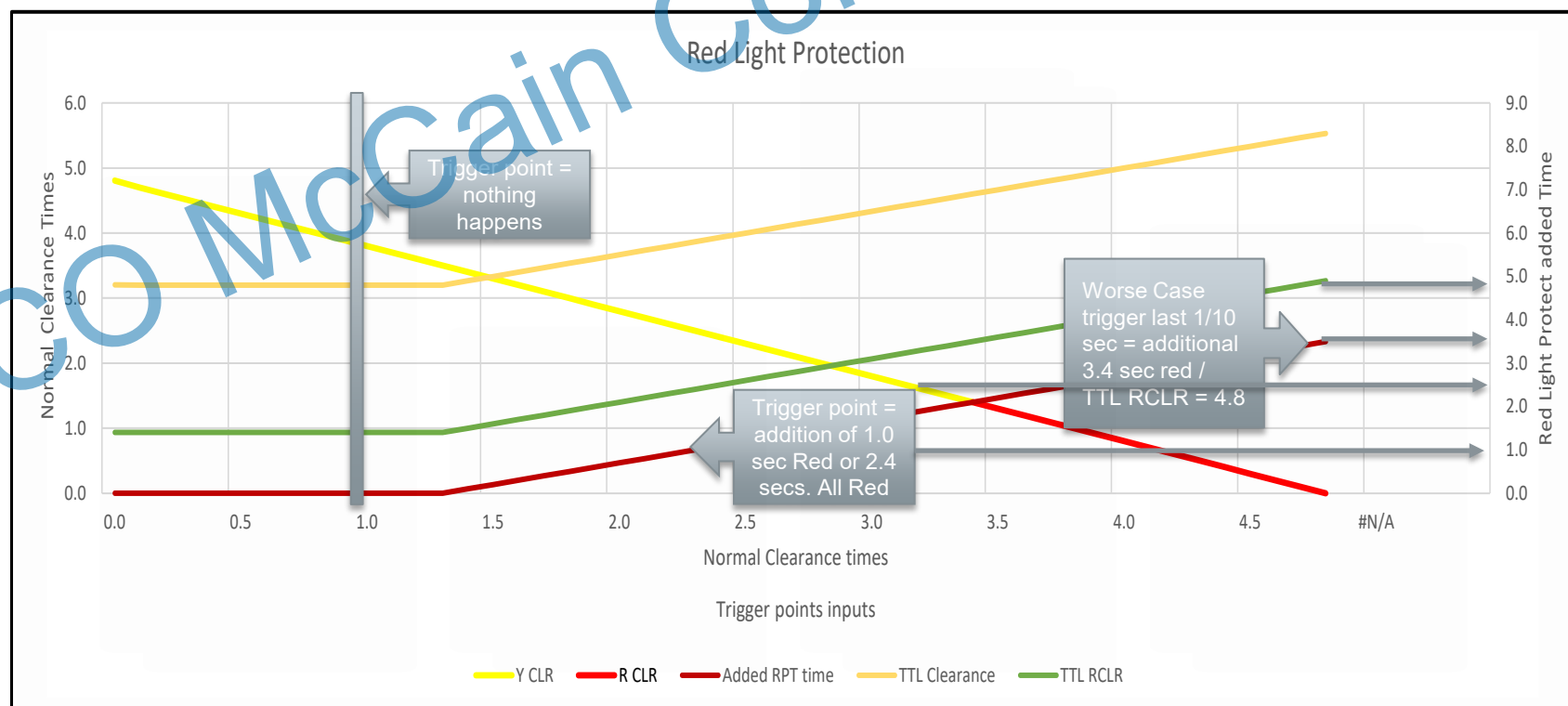
We are not protecting a Red-Light Runner from anything!!

1. Provide a user programmed red protection period for any potential Red-Light Runner.
2. Provide a limit to the number of Red-Light Runners per cycle to reduce disruption on coordination if desired.
3. Provide a limit to the number of Red-Light Runner activations per cycle or per time period (headway) in order to maintain coordination.
4. Work while in coordination or free modes.
5. In 3.4.1 it will provide alerts and alarms and log all activations in both HiRes data logs and controller logs.
6. Omni does not predict the red-light running event.
7. Subject to detector technology that can provide an output when the detector identifies a potential red-light runner. (Non-specific detector technology)

HOW RLP WORKS

1. In this scenario a detector is placed 2 seconds from the stop bar.
 1. Driver more likely to run the red light,
 2. High probability of not stopping.
2. Calculations are made every 1/10th second to determine additional time needed to protect the intersection.
3. Time is only applied if there is a need to add the time.
4. In most cases a fraction of the programmed RLP time is used.
5. Worse case scenario can be protected with most time.
6. Designed to provide smoother operations in coordination.

Yellow clearance	3.4
Red Clearance	1.4
Total clearance	4.8
Red Protect Time	3.4
Total Possible CLR w/ RLP	8.2



DETECTOR TECHNOLOGY AGNOSTIC*



Wavetronix Matrix®



FLIR Trafiradar®



Iteris Vector®



Smartmicro®



Reno A&E Model C®



EDI Oracle®

* The detector must be able to detect a potential red-light runner or accurate ETA.

COMPETITIVE OPERATIONS

McCain SWARCO Omni

Red Light Protect (RLP)

1. Provides a per-pattern Headway or activations per cycle, if desired
2. Provides programming for a red extension up to 25.5 seconds
3. Provides a per phase activation limit up to 2 events per phase if desired.
4. Any of the 128 detector inputs can be used for the trigger from the detection technology.
5. All detector parameters can be used if desired.
6. Omni looks at the input for the whole clearance interval (yellow + red).
7. Time is added as needed to provide the programmed red protection period.
8. Second activation will add additional time to the red protect time.

Econolite ASC3 / Cobalt

Red Max

1. Allows up to 25.5 seconds
2. Holds all red if detection is present during red clearance.
3. Holds red max until detection is removed or max time is reached.
4. Red maximum has no effect when there is no red extension detector present.

Siemens (Yunex) SEPAC

Red Protect

1. Recognizes red light runner calls only during the red clearance.
2. Can use delay and extension with the detector input.
3. Amount of time the detector will hold the controller in an all-red condition and is 0 – 999 seconds
4. Can be programmed essentially with a headway time. No input will be serviced if time programmed has not expired.
5. SEPAC can limit the number of times a red protect call is placed. (Unknown if this is by cycle or by phase)

Intelight / Q-Free MaxTime

+RedClr

1. Add Red Clearance time to the duration of the Phase Red Clearance interval.
2. Not clear how this is activated

Trafficware / Cubic Scout

BikeClr

1. If the bike clear time has not counted down by the time red clearance has terminated, then the phase will hold in red until the remaining bike clearance time has expired
2. Red Extension provides an alarm when Red Clearance is being extended.
3. Not clear how this is activated

SAN BERNARDINO (FIRST FIELD TRIAL)

Setup

- Installed the DB from their 2033 to Omni
- Luke Baker helped with the conversion
- I loaded the DB on a 2070 LX with a 2070-1C
- Setup the 2070 for a 332 cabinet
- Turned on BIUs 10 and 11 and MMU to send on the TS2 configuration
- Setup detectors that would be used in this manner:
 - Detector 32 for phase 2, Detector 34 for phase 4
- Went into I/O mapping and enabled detector channels 32 and 34 or detector 32 and 34.
- Programmed the RLP parameters for 2 seconds.
- Kept number of activations to unlimited.

Implementation

- Iteris setup their Vector for trip lines at 112 feet from the stop bar. That is 2 seconds at 35 MPH.
 - We chose a lower speed to optimize the test
- Once they were set, we connected their system to the 2070 LX and tested inputs to make sure they were getting them into the controller.
- Once that was verified, we swapped their 2070 with our 2070 LX and ran the intersection with our controller.
- Controller was in coordination, but we put it Manual in order to see more Red-Light runners.
- We also reduced the speed to 0 and increased the RLP to 5 seconds so city could see applications of the RLP.
- It worked as expected and San Bernardino was satisfied with the results.

OTHER DEVELOPMENT ON 3.4.0

Minor improvements

- Concurrent Ped termination
- Extended walk using NACT operations to go beyond programmed time.
- Alphabetized Mapping lists and Gate lists for selections.
- TSP
 - Implement TSP arrival window on Coordinated pattern
 - Continued Harmonization
- Min Green on Overlaps is now operational
- 100 second Sync pulse for legacy PEEK systems
- MOE logging in Free operations.
- No Back up Red Revert

DUAL PED TERMINATION

- Used when there are Audible Ped Signals counting down, or saying Don't Walk against a Walk.
- Confusion for Vision Impaired persons on which is the correct crosswalk to listen to.
- Will terminate both peds at the same time regardless of when they start (separately)

1.2	UNIT SETUP
AUTO PED CLEAR	NO
RED REVERT	2.0
MIN YELLOW TIME	3.0
TEXAS DIAMOND MODE	DISABLED
TEXAS DIAMOND TYPE	4-PHASE
DUAL PED CONTROL	DISABLED

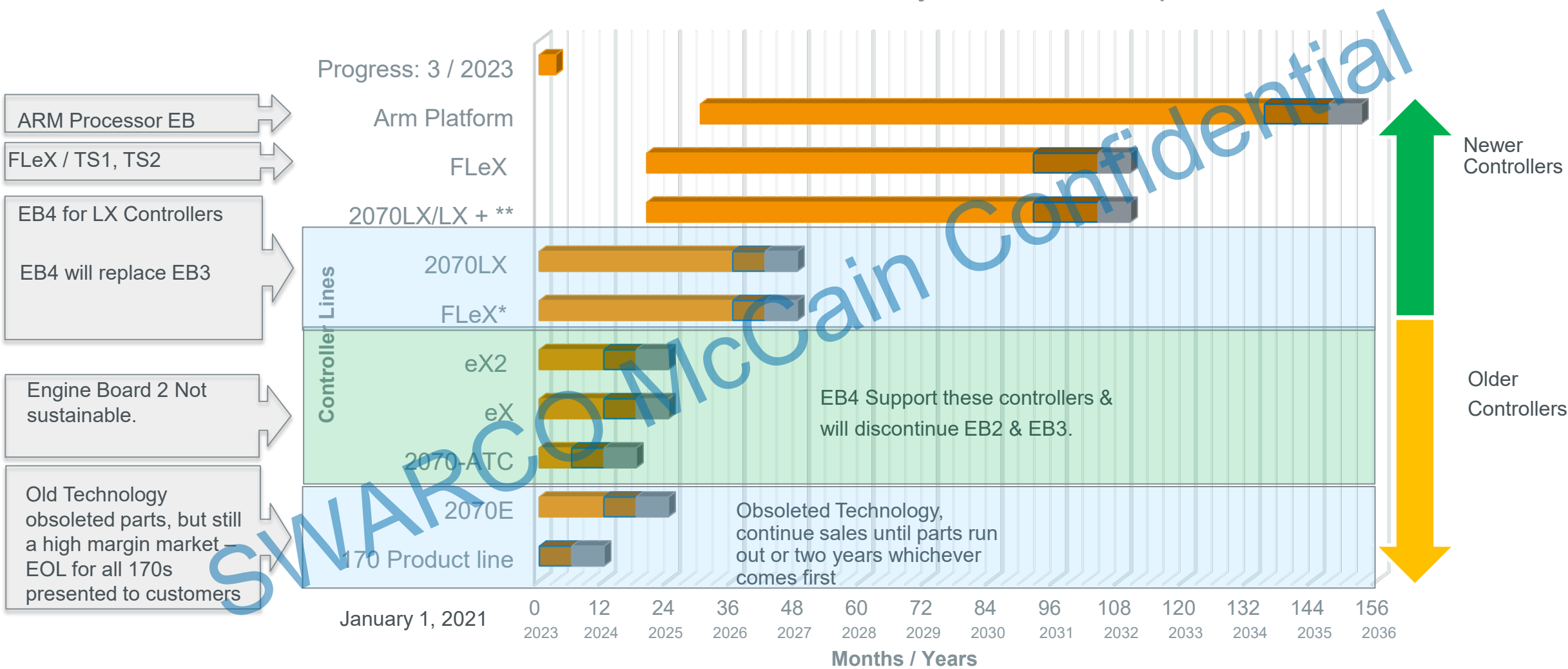
y=YES n=NO End=NEXT

HARDWARE

HERASMO INIGUEZ

CONCEPTUAL MIGRATION PATH

Continued Sales Last Buy time EOL period



* FLeX can also be used for Caltrans Cabinets where Caltrans is not the purchaser.

** 2070 LX + Controller was designed specifically for connected vehicle applications for Caltrans and others, hosts multiple Model 2070 IC CPU Boards (Multiple Engine Boards).

FLeX[®] CONTROLLER LINE

- Now supports:
 - ATC Cabinet
 - NEMA Cabinet
 - Caltrans Cabinet



ATC EX / EX2 CONTROLLERS

- EB4 Supports eX and eX2



EB4 WILL BE THE STANDARD ENGINE BOARD

Features and Security

Feature	Description
Linux 5.X Kernel	Kernel 5.10.105
CA AB 1906	✓ California law on security of connected devices
SHA 512	✓ Security
SFTP	✓ Security
SSH	✓ Security
SCP	✓ Security
TLS 1.3	✓ Security
Public Key Infrastructure (PKI)	✓ Security
ECDSA	✓ Security
DOS Protection	✓ Security
glibc	v3.30
Flash Memory	512 MB
RAM	256 MB
SRAM	2 MB
Busybox	Busybox v1.31.1
Standards	ATC v6A.37 & TEES 2020

