



NXP

Mobile Robotics solutions

for drones / UAS

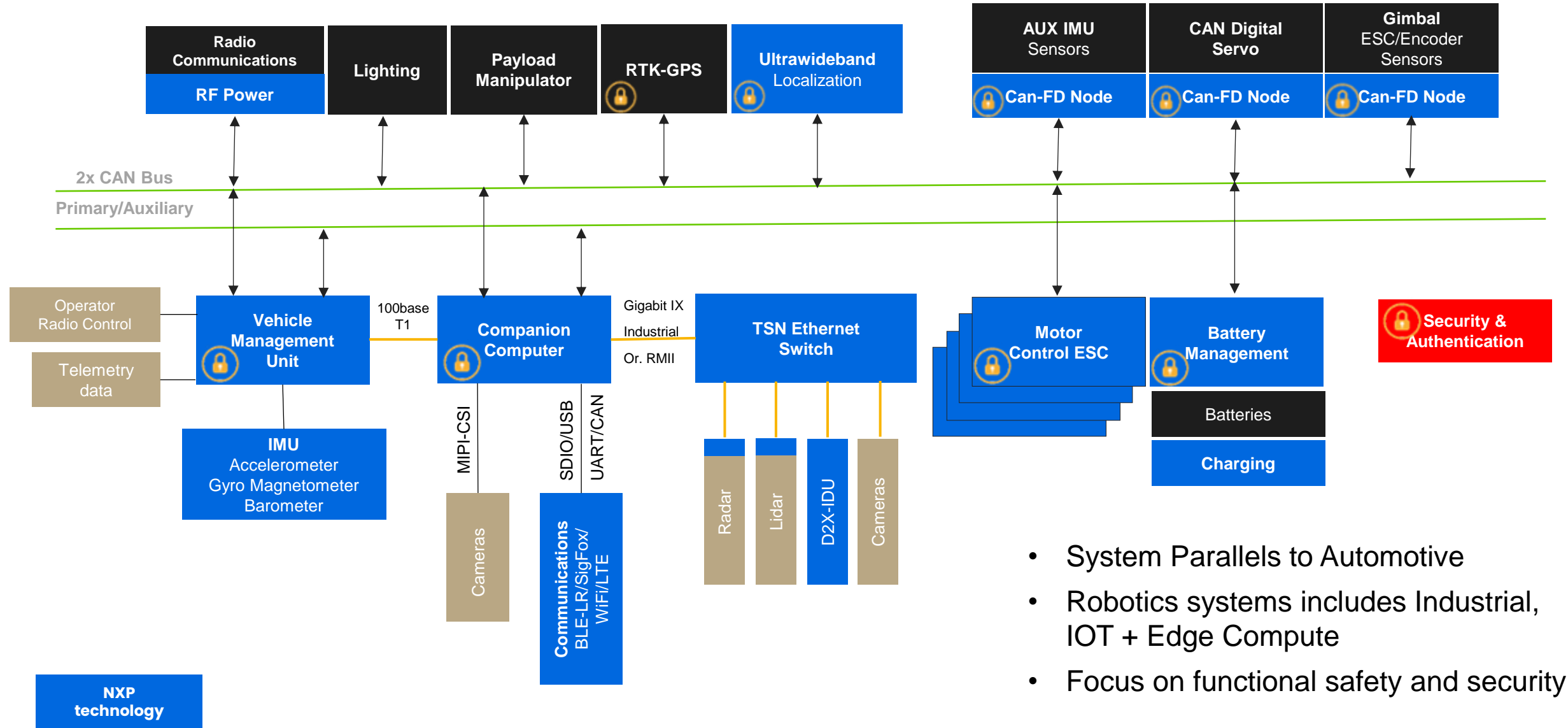
**Reference designs, Evaluation Kits,
Enabling Software**

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Mobile Robotics, CTO SI CC

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Systems Block Diagram: Mobile Robotics





NXP Reference designs

MR-VMU-RT1176 / Pixhawk V6X-RT

8MPNavQ / NavQPlus

NavQ95

RDDRONE-TIADAPT

MR-TIETH8

RDDRONE-BMS772

RDDRONE-BMS771

UCANS32K146 / UCANS32K1SIC / UCANS32K1SCT

MR-CANHUBK344

Next Generation Real time Vehicle Management Unit

MR-VMU-RT1176, Pixhawk V6X-RT Standard compliant



FMUM Processor: NXP i.MX RT1176

- 32 Bit Arm® Cortex®-M7, 1GHz
- 32 Bit Arm® Cortex®-M4, 400MHz secondary core
- 64MB external flash memory
- 2MB RAM

NXP EdgeLock SE051 hardware secure element

- IEC62443-4-2 certified for the applicable requirements
- 46 kB user memory with personalization options to go up to 104 kB
- Groundbreaking CC EAL6+ certified solution for IoT deployments
- AES and 3DES encryption and decryption

On-board sensors

- Accel/Gyro: ICM-20649 or BMI088
- Accel/Gyro: ICM-42688-P
- Accel/Gyro: ICM-42670-P
- Mag: BMM150
- Barometer: 2x BMP388

MR-VMU-RT1176 is officially supported by

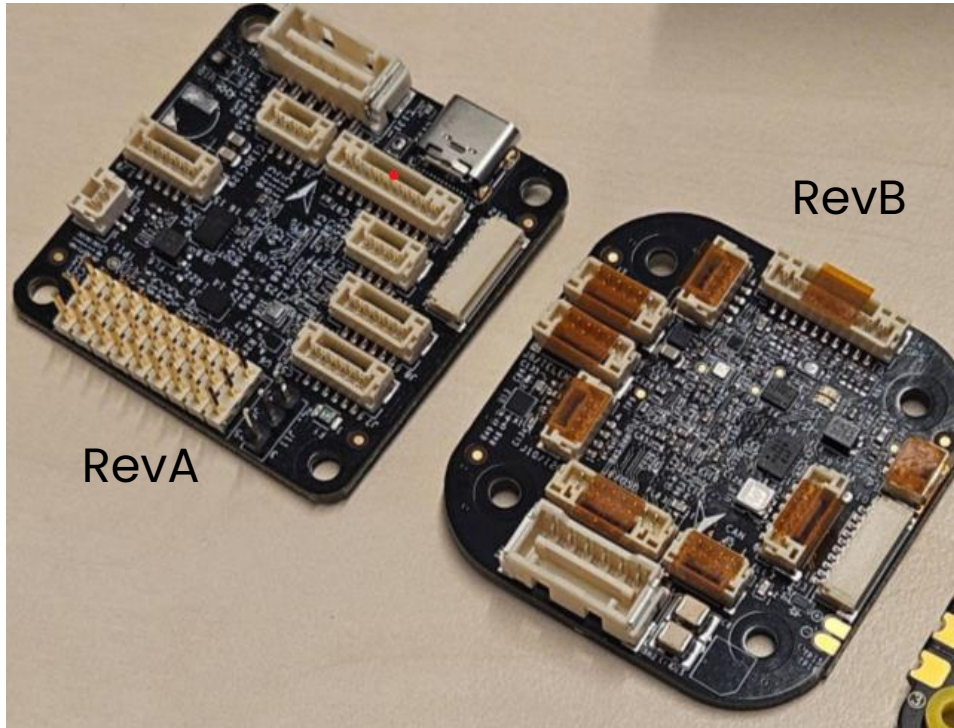


NXP reference design available from [NXP.com](https://www.nxp.com)
Documentation available on px4.io

Real time Vehicle Management Unit for small vehicles

MR-VMU-TROPIC

Under active development and test-flying



Processor: NXP i.MX RT1064

- 32 Bit Arm® Cortex®-M7, 600MHz
- 4MB internal flash memory
- 1024kB SRAM

On-board sensors

- Accel/Gyro: BMI088
- Accel/Gyro: ICM-42686-P
- Mag: BMM350
- Barometer: BMP390

Interfaces

- USB-C
- 3x Telemetry UART with RTS,CTS
- GPS port (UART,I2C,LED,Buzzer)
- I2C port
- SPI port
- CAN-FD bus
- Debug port
- 100base-T1 ethernet

Connectors follow the Dronecode standard.

- RCin (with telemetry out, 4pin JST-GH)
- 8x PWM out (2x4, Dshot capable)
- 1x Dshot telemetry in

supported by



Supported MCU Software From Mobile Robotics Team

NXP Business lines offer standard software for each of the various MCUs in. Typically includes MCUXpresso or S32 Design Studio IDE. Several compiler options and third-party add-ons.

DroneCode standard software:

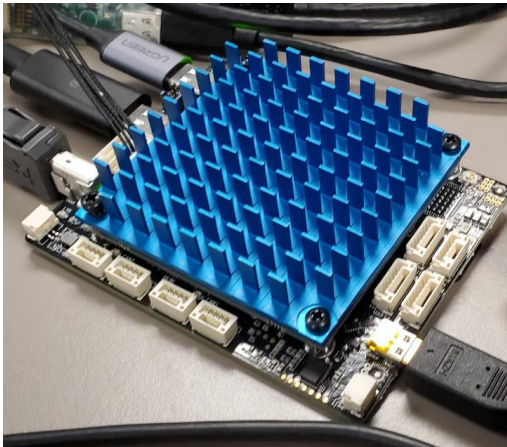
- PX4 flight stack with **curated branch PX4/NuttX** RTOS
- NuttX RTOS mainline
- Use GCC compiler, VSCode IDE
- Can work with NXP MCUXpresso IDE
 - Segger task-aware debugging may be available for NuttX



Notable new Opensource software:

- Zephyr RTOS
- Cognipilot cerebri vehicle control stack running on top of Zephyr RTOS
- FreeRTOS





NavQPlus Mission Computer

- i.MX8M-plus MPU (4x Cortex-A53, 1.8 GHz) with customization also available from 3rd party.
- 8Gb RAM, 32Gb flash, SD-Card interface
- Machine Learning using **2.3TOPS NPU accelerator**, eIQ ML Software development environment w/TFLite, ArmNN, ONNX
- **Yocto** Linux, **Ubuntu POC**** and **ROS2** enablement.
- Vision – Dual MIPI camera w/ ISPs, hardware codec accelerators
- WiFi 5 / BTLE 5.0
- Dual Ethernet 100BaseT1 “2-Wire” + IX industrial IGB
- 2x USB-C with up to 20V power input + external power input
- 2x CAN (TJA1463)
- [SE050](#) EdgeLock secure element with NFC interface
- RTC with tamper timestamping
- Display support for groundstations. Up to three displays simultaneously MIPI, LVDS, HDMI (w/CEC)

** Customized Ubuntu Core also available from Canonical

Available from [NXP.com](https://www.nxp.com)
Documentation on [Gitbook](#)

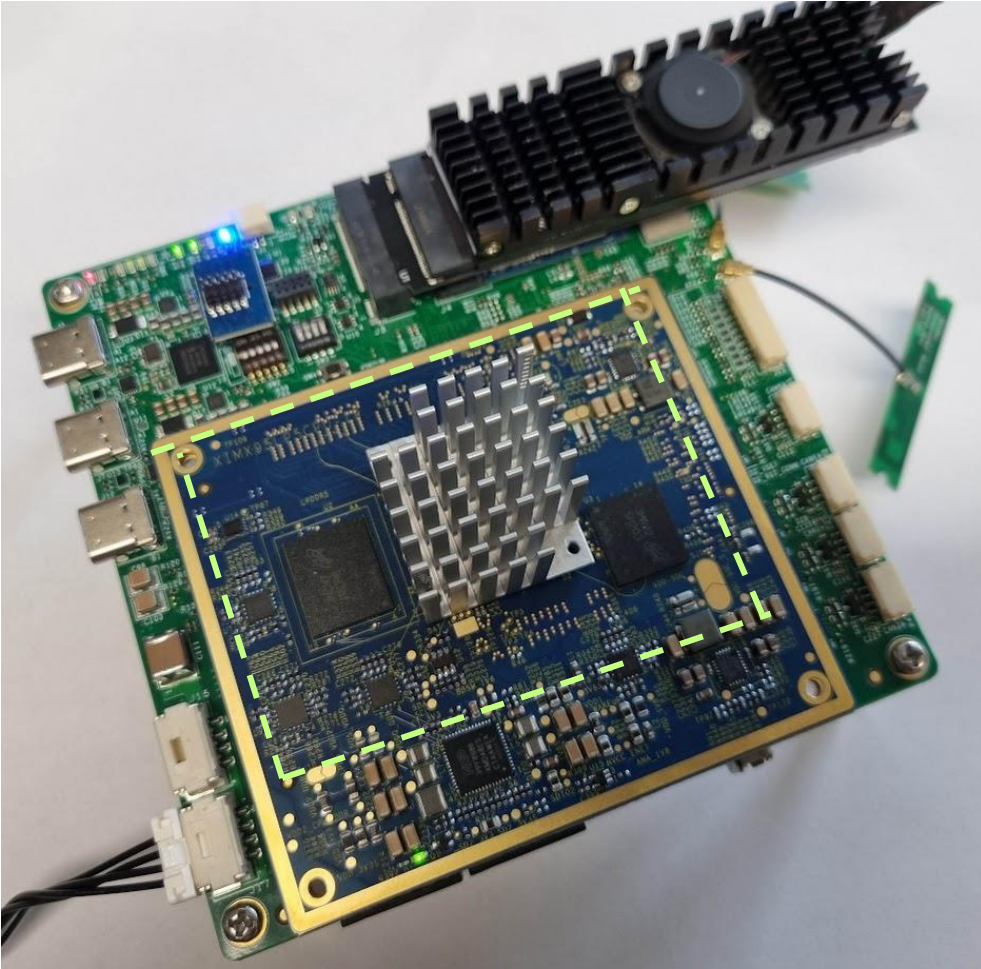


NavQ95 - Next generation drone / vehicle control

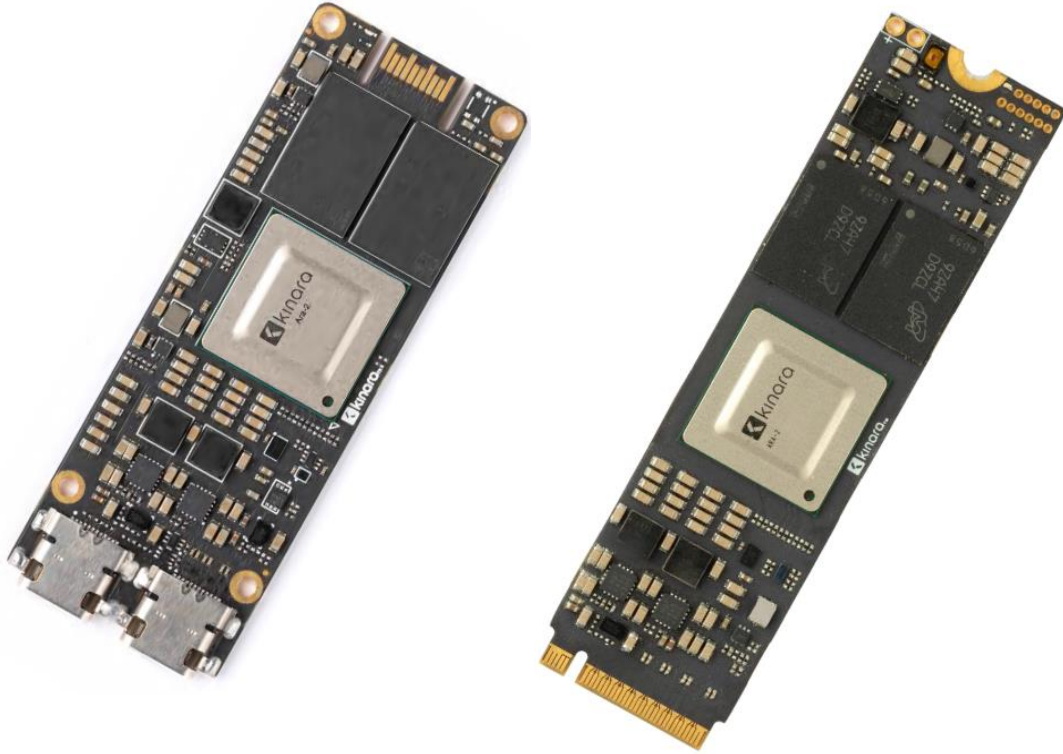
Under active development V0->V1

Single chip drone control based on i.MX95

- 6x Arm® Cortex-A55 multicore complex
- 1x Arm Cortex-M7 ← Real time controller
- 1x Arm Cortex-M33 ← System manager
- NXP eIQ® Neutron Neural Processing Unit
- Reference design board uses dronecode connector standard
- PX4 already ported to M7 core. Also Zephyr.
- Yocto based Linux with Ubuntu 24.04 and ROS2 Jazzy
- 2x M.2 PCIe: Modem, Storage or Kinara ARA-2 NPU



Kinara Ara-2



<https://kinara.ai/products/kinara-ara-2/>

- Embedded AI processor.
- Performance: Up to 40 TOPS (Tera Operations Per Second)
- Neural Cores: 8 second-generation neural cores
- Memory Support: Up to 16GB LPDDR4(X)
- Power Efficiency: Operates at <2W in typical vision applications
- Runs Large Language Models (LLMs) like LLaMA-2 and Stable Diffusion at the edge:
- ~12 tokens/sec for 7B parameter LLMs
- ~10 seconds/image for Stable Diffusion 3
- Optimized for CNNs, vision transformers, and multi-model inference
- Supports high-accuracy quantization and FP32 directly

Supported MPU Software From Mobile Robotics Team

NXP “standard” software is Yocto based Linux



NXP NavQ Ubuntu Demo image

- Ubuntu filesystem on top of Yocto Kernel
- ROS2 “Robot operating system” framework.
- Many other standard packages
 - NXP eIQ, OpenCV,
 - Cyclone DDS services, SocketCAN etc



In development

- Zephyr on embedded MCU core on MPU
- Support for Cognipilot and Real time controller connections (Zenoh)

ISO26262 and ASIL

ASIL Level	Autonomous Driving Component	Why This Level?
ASIL D	Emergency braking, steering control, powertrain override	Failure could cause fatal accidents — highest safety rigor required
ASIL C	Adaptive cruise control, lane keeping assist	High risk if malfunctioning, but some driver control remains
ASIL B	Sensor fusion, object classification, path planning	Important for decision-making, but not directly life-critical
ASIL A	Driver alerts, infotainment integration, non-critical diagnostics	Low safety impact if failed
QM	Cabin lighting, entertainment systems	No safety impact — standard quality control is sufficient



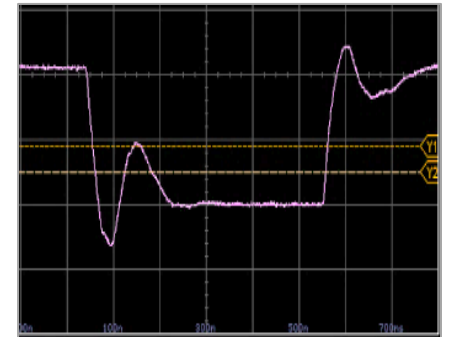
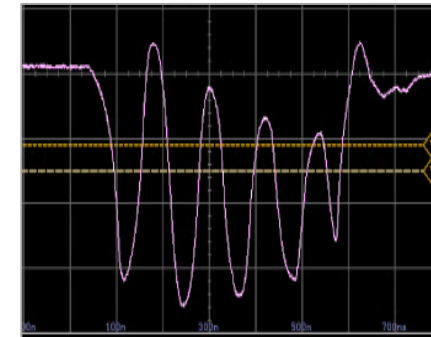
UCANS32K1SIC (KIT-UCANS32K1SIC)

CAN node board



UCANS32K1SIC Signal
Improvement CAN Phy

- Low-cost development board for CAN-FD
- NuttX RTOS and as PX4/NuttX target
- NXP traditional automotive software and bare metal
- Bridge I2C/SPI sensors and/or actuators CAN-FD
- NXP parts:
 - [S32K146](#) Automotive MCU (**ASIL-B**)
 - [TJA1463ATK](#) Automotive CAN-FD Signal improvement (SIC) transceiver – Direct Replacement
 - [SE050](#) EdgeLock secure element with NFC interface



Available from [NXP.com](https://www.nxp.com)

Documentation on [Gitbook](#)



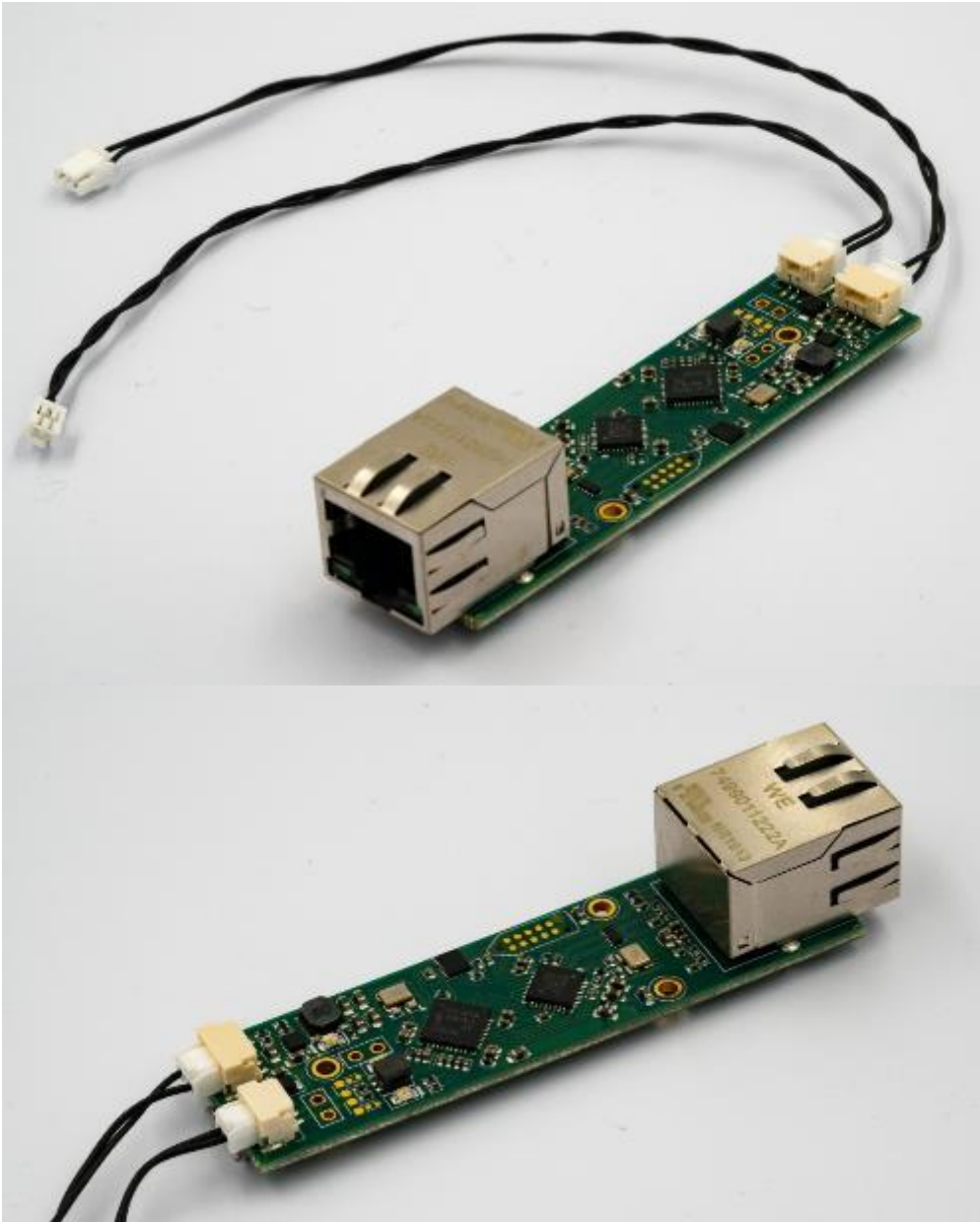
RDDRONE-T1ADAPT

100base-T1 to RJ45 Adapter

- Stand alone T1 “two wire” ethernet adapter reference design for fast evaluation or adaptation
 - Laptop to T1 network
 - Between two T1 adapters
 - Allow existing embedded board to use T1
- NXP components
 - TJA1101 Ethernet PHY (ASIL-A) (**TJA1103 ASIL-B**)
 - LPC microcontroller
 - USB or other 5V input

Available from [NXP.com](https://www.nxp.com)

Documentation on [Gitbook](#)





MR-T1ETH8

8Port 100base-T1 Ethernet switch

- 100BaseT1 “two wire” ethernet switch application reference design*
 - (6x) 100Base-T1 Two wire Ethernet
 - (1x) 100Base-TX Ethernet w/ traditional RJ45
 - (1x) 1000base-TX Gigabit w/ IX industrial connector
- NXP parts
 - SJA1110 10 port ethernet switch IC supporting TSN (**ASIL-B**)
 - VR5510 Automotive PMIC (ISO 26262, **ASIL-B** and ASIL-D)
 - SE050 Secure Element with NFC interface
- Small 75x50mm board

Available from [NXP.com](https://www.nxp.com)

* Please use [SJA1110-EVM](#) for intensive development. This board intended only as a form-factor target following software vetting on EVM.



RDDRONE-BMS772 (3-6cells)



- Battery management system with CAN-FD and SMBUS (i2c)
- Flexible - differentiated by MCU oversight of functions
- Multiple chemistries supported, security, certificates, passive cell balancing
- NXP components
- [MC33772](#) Automotive 6 cell BCC IC (*MC33771 14 cell in pre-release*)
 - **ASIL-C, ASIL-D**
- [S32K144](#) Automotive MCU (**ASIL-B**)
- A1007 Secure Element for authentication, secure cycle counts, flags
- NTAG5 NFC allows checking battery pack from mobile phone
- UJA1169 Systems basis chip
- OLED Display optional
- Software: NuttX OS + BMS libraries/applications
- droneCAN message protocol support
- MBDT: Model Based Design Toolbox, Matlab Simulink models
- Other uses: e-bike, scooter, power tools, portable medical



Available from [NXP.com](https://www.nxp.com)
Documentation on [Gitbook](#)

RDDRONE-BMS771 (7-14cells)



- Battery management system with CAN-FD and SMBUS (i2c)
- Flexible - differentiated by MCU oversight of functions
- Multiple chemistries supported, security, certificates, passive cell balancing
- NXP components
 - [MC33771](#) Automotive 14 cell BCC IC (**ASIL-C ASIL-D**)
 - [S32K146](#) Automotive MCU (**ASIL-B**)
- Software: Example NuttX OS + BMS libraries/applications
- DroneCAN message protocol support
- **MBDT**: Model Based Design Toolbox, Matlab Simulink models



Other uses: e-bike, scooter, power tools, portable medical

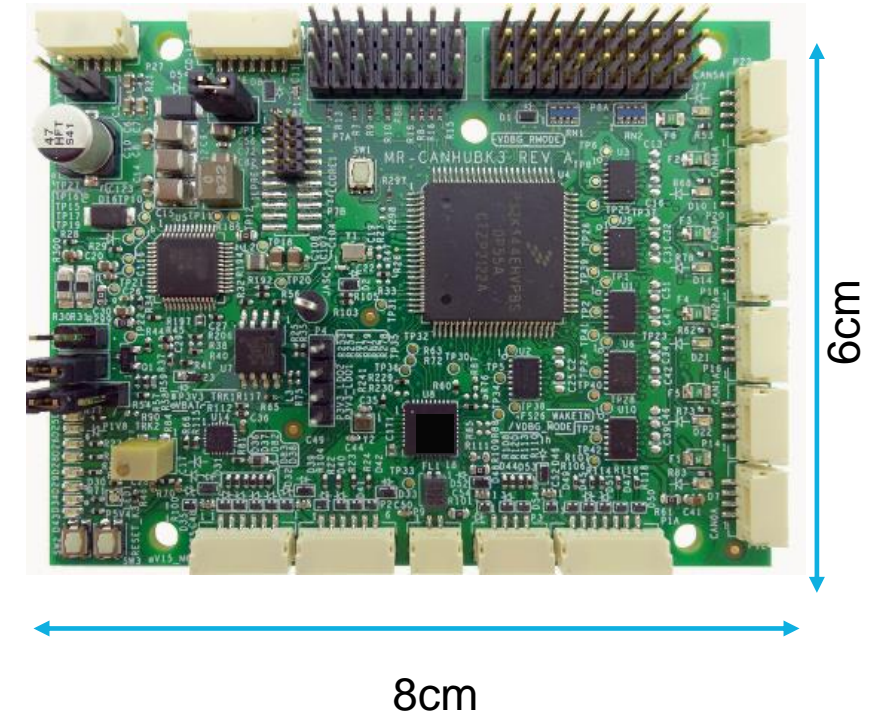
Available from [NXP.com](https://www.nxp.com)

MR-CANHUBK344 application built for Mobile Robotics



S32K344 Automotive MCU features:

- Dual **lockstep** M7@160Mhz MAXQFP package, **ASIL-D** capable
 - **Fault Collection and Control Unit (FCCU)**
- FS26xx Automotive PMIC
- **6 x CAN transceivers**
 - 2 xCAN-FD, 2xCAN-SIC, and 2xCAN-SCT (Secure)
- TJA1103 2-wire 100BASE-T1 ethernet transceiver
- 4x UART, 2x I2C, 3xSPI
- IMU connector
- GPIO and PWM on header
- SE050 Secure Element with NFC
- Design able to accommodate S32K3x4 dual core parts i.e. Motor control potential
 - Core 1: Motor control application
 - Core 2: RTOS w/ Ethernet/SocketCAN, etc.
- Example robotics application of Cognipilot on Zephyr for MR-B3RB (Buggy3)



Available from [NXP.com](https://www.nxp.com)
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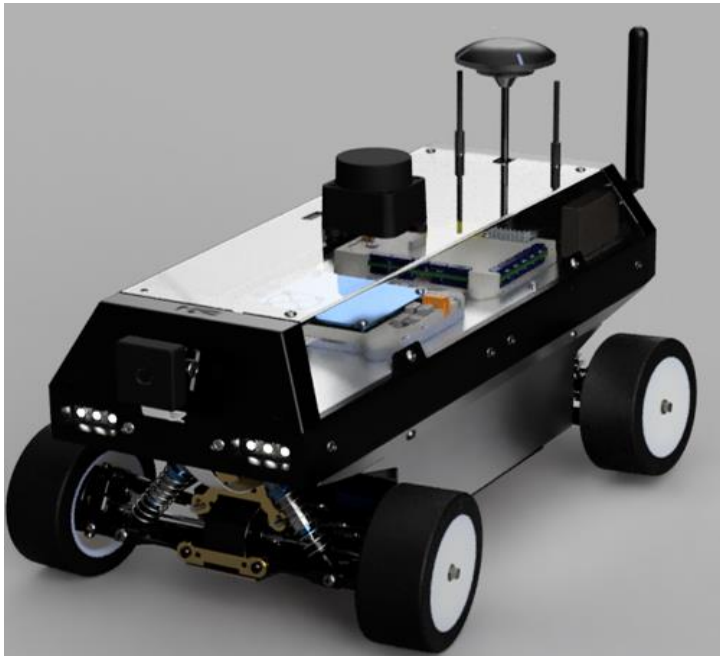
NXP Hovergames

Drone and Rover
development kits



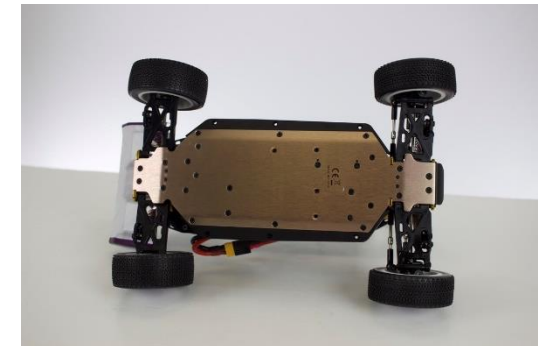
MR-B3RB-M

Rover developer kit.
Used in HoverGames,
RoverGames, AIM and NXP-CUP



With **MR-CANHUBK344** running **Cognipilot**
cerebri or PX4 as VMU, GPS, Telemetry

NavQPlus Linux ROS2 companion computers,
CAN node modules, BMS, T1 Ethernet hub, small
LIDAR and other sensors



MR-HGK-RT

Complete Reference drone kit



- Robotic Drone featuring MR-HGK-RT1176
- Complete kit with RC remote, debugger, all accessory components
 - Carbon fiber mechanical frame approx. 500 mm diagonal size, 150 mm x 150 mm large top and bottom plate for mounting electronics, dual 10mm diameter rod x 60mm rail mounting system.
 - Order LiPo battery and telemetry radio separately (HGD-TELEM915/433)
- Industry standard PX4 software
- 100BaseT1 2-Wire Ethernet
- EdgeLock® SE05x secure element

[Gitbook](#) documentation

Available from distributors and [NXP.com](https://www.nxp.com)



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