## Emissive Display Technology in Aerospace Applications

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### Emissive Display Technology
- Compared to traditional transmissive displays, emissive display technology has greater advantages such as an improved lifetime, wider viewing angles, and smaller form factor integration capabilities.
- Applying emissive displays within existing aircraft cockpit controls introduces an easily programmable and versatile display.
- New technologies can pave the way for incorporating more advanced display systems such as micro-LEDs.

### System Design

#### Software
- Programmed with Arduino IDE.
- Utilizes SSD1331 libraries to communicate to the display.
- SPI communication is utilized between the RP2040 microcontroller and the OLED.
- Switch logic drives connect to RP2040 GPIO.

#### Hardware
- The RP2040 microcontroller manages the display-user communication.
- Hardware implementation prioritizes necessary microcontroller functions.
- Power from the switch source supplies to the microcontroller and SSD1331 OLED.
- The microcontroller connects via USB, reading switch states from a physical module.

#### Korry Switch Model
- Utilizing the Korry 1,380 LED momentary switch.
- Small form factor switch cap can be replaced for display electronics.
- Small PCB designs prevent switch part redesigns.

### OLED Driver
- The OLED PCB board includes:
  - Display ribbon connections.
  - Boost converter for display driving.
  - Net routing for SPI protocols to the display.

### Custom Microcontroller
- The microcontroller strips down the standard development board to the essentials:
  - USB connectivity via micro-b connector.
  - 16 MB Flash Memory.
  - 12 MHz Crystal Oscillator.
  - 9 GPIO total with 5 GPIO using SPI controller.

### Adjusted Switch Cap
- Original model: Cap with spring base and LED backlighting.
- Our model: Spring base integrated, custom microcontroller inside cap, OLED Driver on top.
- Additional features: Transparent screen protection, USB access hole for programming.

### Final Product
- The final product demonstrates an OLED display fully integrated into a Korry Electronics switch, supplied with power only through the switches' header.
- Fully housed and connected switch connected to external power. Able to properly display logical switch states assigned to it.
- Laminated cover over OLED display
- OLED PCB mounted on the caps front cover
- Microcontroller board vertically mounted below the OLED
- 3D printed custom housing
- Power connections to switch base

### Future Work, References, & Acknowledgments
- Implement the micro-LED from Korry Electronics obtained through Play Nitride.
- Implement more software switch functionality and drivers.
- Update designs to be rugged for aerospace applications.

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**SPONSOR:** Korry Electronics