# Memory Margin Analysis

To satisfy **DO-178C Objective A-7 #10**, a **Memory Margin Analysis** was conducted to ensure that memory resource usage remains within defined safety limits, thereby supporting system reliability and accommodating future scalability.

For the **Communication board and Display board** in the **UH-60X Howell Display Unit (HDU)**, memory utilization was assessed for all relevant memory types, specifically **SRAM** and **FLASH**. The analysis adheres to the program-defined threshold that **no more than 80%** of the available memory may be used under peak operating conditions.

The current memory usage percentage was calculated using data extracted from the **build-time .map file** generated for the **STM32F407IGT6 and STM32F767BIT6** processor. This measurement confirms that at least **20% of memory capacity** remains available, providing sufficient headroom for software growth, updates, or configuration changes without compromising system behaviour, determinism, or stability.

All tested communication and display software configurations meet the memory margin requirement and fully support the satisfaction of **DO-178C Objective A-7 #10** related to resource usage verification.

## HDU Communication Module

Memory Margin Analysis for Howell Display Unit of communication Module for the baseline HDU\_SOI3\_RELEASE\_04:

( [https://bitbucket.org/machglobaltech-sw/du\Software\SourceCode\Release\ HDU\_SOI3\_RELEASE\_04\H108E-137](https://bitbucket.org/machglobaltech-sw/du\Software\SourceCode\Release\HDU_SOI3_RELEASE_04.zip\HDU_SOI3_RELEASE_04\H108E-137e))

### H108E-137- Flight Application Software

Memory Margin Analysis for Howell Display Unit of Communication Module Flight Application Software

#### Flash Memory Analysis - H108E-137(HDU-004-003)- Flight Application Software

Table 1: Flash Memory Analysis for H108E-137

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| Flight Application | 256 | 27.53 | 10.75 |
| Total | 256 | 27.53 | 10.75 |
| Free Space | - | 228.47 | 89.24 |

#### SRAM Memory Analysis - H108E-137(HDU-004-003)- Flight Application Software

*Table 2: SRAM Memory Analysis for* H108E-137

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| SRAM | 112 | 61.66 | 55.05 |
| BB\_SRAM | 16 | - | - |
| Total | 128 | 61.66 | 48.17 |
| Free Space | - | 66.34 | 51.83 |

### H108E-136- Module Configuration Data

Memory Margin Analysis for Howell Display Unit of Communication Module Configuration Data

* + - 1. **Flash Memory Analysis - H108E-136(HDU-004-004)- Module Configuration Data**

Memory Margin Analysis for Howell Display Unit Module Configuration Data.

*Table 3: Flash Memory Analysis for H108E-136*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| Boot Loader Data | 64 | 14.75 | 23.05 |
| Total | 64 | 14.75 | 23.05 |
| Free Space | - | 49.25 | 76.95 |

* + - 1. **SRAM Memory Analysis - H108E-136(HDU-004-004)- - Module Configuration Data**

*Table 4: SRAM Memory Analysis for H108E-136*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| SRAM | 112 | 18.47 | 16.49 |
| BB\_SRAM | 16 | - | - |
| Total | 128 | 18.47 | 14.43 |
| Free Space | - | 109.53 | 85.57 |

### Flash memory Usage for HDU Communication Module

*Table 5: Total Flash Memory Analysis for Communication Software*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| Flight Application | 256 | 27.53 | 10.75 |
| Boot Loader Data | 64 | 14.75 | 23.04 |

### SRAM Memory Usage for HDU Communication Module

*Table 6: Total SRAM Memory Analysis for Communication Software*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| SRAM | 128 | 61.66 | 48.17 |
| Total | 128 | 61.66 | 48.17 |

Note:

SRAM analysis for the H108E-136 (Module Configuration Data) represents the smaller value than the H108E-137, as the H108E-137 (Flight Application) represents the larger and more memory-intensive component of the system. Since H108E-137 utilizes only 48.17% of available SRAM and H108E-136 has minimal functionality limited to configuration data, its memory usage is inherently lower. Thus, SRAM analysis for H108E-137 is sufficient to demonstrate compliance with DO-178C Objective A-7 #10 for both modules.

* 1. **HDU Display Module**

Memory Margin Analysis for Howell Display Unit of Display Module for the baseline HDU\_SOI3\_RELEASE\_04:

( [https://bitbucket.org/machglobaltech-sw/du\Software\SourceCode\Release\ HDU\_SOI3\_RELEASE\_04\H108E-799](https://bitbucket.org/machglobaltech-sw/du\Software\SourceCode\Release\%20HDU_SOI3_RELEASE_04\H108E-799))

### H108E-799 - Flight Application Software

Memory Margin Analysis for Howell Display Unit of Display Module Flight Application Software

* + - 1. **Flash Memory Analysis - H108E-799 (HDU-004-001) - Flight Application Software**

*Table 8: Flash Memory Analysis for H108E-799*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| Flight Application | 1024 | 716.16 | 69.94 |
| Total | 1024 | 716.16 | 69.94 |
| Free Space | - | 307.84 | 30.06 |

* + - 1. **SRAM Memory Analysis** **- H108E-799 (HDU-004-001) - Flight Application Software**

Table 9: *SRAM Memory Analysis for H108E-799*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| SRAM | 500 | 66.10 | 13.22 |
| Total | 500 | 66.10 | 13.22 |
| Free Space | - | 433.9 | 86.78 |

* + - 1. **SDRAM Memory Analysis - H108E-799(HDU-004-001) - Flight Application Software**

*Table 10: SDRAM Memory Analysis for* H108E-799

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| SDRAM | 24576‬ | 0.019 | 0.000079 |
| Total | 24576‬ | 0.019 | 0.000079 |
| Free Space | - | 24575.98 | 99.99 |

* + - 1. **SDRAM2 Memory Analysis - H108E-799(HDU-004-001) - Flight Application Software**

*Table 10:* SDRAM Memory Analysis for H108E-799

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| SDRAM2 | 8192 | 55.10 | 0.67 |
| Total | 8192‬ | 55.10 | 0.67 |
| Free Space | - | 8136.91 | 99.32 |

### H108E-795 - Module Configuration Data

Memory Margin Analysis for Howell Display Unit of Display Module Configuration Data

#### Flash Memory Analysis - H108E-795 (HDU-004-001) - Module Configuration Data

*Table 11: Flash Memory Analysis for H108E-795*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| Boot Loader Application | 64 | 41.90 | 65.47 |
| Total | 64 | 41.90 | 65.47 |
| Free space | - | 22.‬1 | 34.53 |

#### SRAM Memory Analysis - H108E-795(HDU-004-001) - Module Configuration Data

*Table 12: SRAM Memory Analysis for H108E-795*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| SRAM | 256 | 3.74 | 1.46 |
| Total | 256 | 3.74 | 1.46 |
| Free space | - | 252.26 | 98.53 |

### Flash memory Usage for HDU Display Module

*Table 13: Flash Memory Analysis for Display Software*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| Flight Application | 1024 | 716.16 | 69.94 |
| Boot Loader Application | 64 | 41.90 | 65.47 |

### **SRAM Memory Usage for HDU Display Module**

*Table 14: SRAM Memory Analysis for Display Software*

|  |  |  |  |
| --- | --- | --- | --- |
| **Partition** | **Size (KB)** | **Used (KB)** | **Current Usage (%)** |
| SRAM | 500 | 66.10 | 13.22 |
| Total | 500 | 66.10 | 13.22 |

Note:

SRAM analysis for the H108E-795 (Module Configuration Data) represents the smaller value than the H108E-799, as the H108E-799 (Flight Application) represents the larger and more memory-intensive component of the system. Since H108E-799 utilizes only 13.22% of available SRAM and H108E-795 has minimal functionality limited to configuration data, its memory usage is inherently lower. Thus, SRAM analysis for H108E-799 is sufficient to demonstrate compliance with DO-178C Objective A-7 #10 for both modules.