

Ground Control Station Case Design Guide

Deployment-Ready Protection System

前言

隨著無人機 (UAV) 任務逐漸朝向長距離、即時影像回傳、多機協同與全天候作戰發展，地面控制站 (Ground Control Station, GCS) 已成為整個無人機系統的大腦。

一套優秀的地面控制站不僅是筆記型電腦加上天線設備，而是整合：

- * 指揮控制 (Command & Control)
- * 任務規劃 (Mission Planning)
- * 即時監控 (Real-Time Monitoring)
- * 通訊鏈路 (Communication Link)
- * 資料管理 (Data Management)

因此，地面控制站箱體的設計，必須從「設備保護」提升至「任務部署系統」的層級思考。

第一章

地面控制站的角色定位

在完整的 UAV 系統中：

UAV System

- |
- └─ Flight Platform
- └─ Payload System
- └─ Communication System
- └─ Power System
- └─ Ground Control Station

地面控制站為整個系統的核心控制節點。

主要功能：

飛行控制

- * 起飛
 - * 巡航
 - * 降落
-

影像監控

- * EO 可見光
 - * IR 熱影像
 - * 夜視系統
-

數據管理

- * 飛行紀錄
 - * 任務資料
 - * GIS 資訊
-

通訊管理

- * RF 模組
 - * LTE
 - * 5G
 - * 衛星通訊
-

第二章

地面控制站常見組成

顯示系統

配置：

- * 工業電腦
 - * Rugged Laptop
 - * 工控顯示器
-

通訊系統

配置：

- * RF Module
 - * Mesh Radio
 - * LTE Router
 - * 衛星通訊設備
-

電源系統

配置：

- * UPS
 - * 電池模組
 - * AC/DC 轉換器
-

控制系統

配置：

- * 遙控器
 - * 操作面板
 - * 搖桿控制器
-

第三章

地面控制站箱體設計原則

原則一

開箱即戰備

Open & Operate

開啟箱體即可進行任務。

避免現場重新組裝。

原則二

快速部署

建議：

5 分鐘內完成架設。

原則三

設備整合

所有設備固定於箱體內。

避免現場拆裝。

原則四

模組化設計

便於：

- * 維修
 - * 升級
 - * 擴充
-

原則五

運輸保護

適用：

- * 陸運
 - * 海運
 - * 空運
-

第四章

箱體架構設計

上蓋區域

配置：

- * 顯示器
 - * 文件袋
 - * 天線收納區
-

中央設備區

配置：

- * 工業電腦
 - * Rugged Laptop
 - * 控制設備
-

下層區域

配置：

- * 電源模組
 - * UPS
 - * 配線系統
-

第五章

顯示系統設計

單螢幕配置

適用：

- * 小型無人機
 - * FPV 系統
-

雙螢幕配置

適用：

- * VTOL

- * 中大型固定翼

三螢幕配置

適用：

- * 軍工任務

- * 多機控制

第六章

通訊模組設計

可整合：

RF Module

Mesh Network

LTE / 5G

SATCOM

設計重點：

- * 散熱

- * EMI 隔離

- * 快速更換

第七章

電源系統設計

配置：

- * AC Input
 - * UPS
 - * Battery Backup
-

設計目標：

停電狀況下維持：

30~120 分鐘運作能力。

第八章

IP67 防護設計

地面控制站常面臨：

- * 雨天
 - * 沙塵
 - * 海岸鹽害
-

建議：

IP67

防塵

防潑水

防雨

第九章

泡棉與避震設計

推薦：

EVA

適用：

* 顯示器

* 電腦設備

EPE

適用：

* 大型部署系統

ESD EVA

適用：

* 電子模組

* 通訊設備

第十章

地面控制站箱體分類

Type A

Portable GCS

手提式

適用：

FPV

小型無人機

Type B

Mobile GCS

拉桿式

適用：

中型任務

Type C

Tactical GCS

戰術型

適用：

軍工任務

Type D

Rack Mount GCS

機櫃式

適用：

指揮中心

第十一章

工程設計流程

需求確認

↓

設備丈量

↓

配置規劃

↓

泡棉設計

↓

機構設計

↓

打樣驗證

↓

量產交付

第十二章

非紅供應鏈規劃

HY Performing Case 堅持：

MIT Taiwan Manufacturing

台灣製造

Non-China Supply Chain

非紅供應鏈

可提供：

* COO

* COC

* 材料來源證明

* 生產履歷

符合：

* 軍工專案

* 政府採購

* 海外出口需求

第十三章

Ground Control Station 部署架構

Ground Control Station

|

└─ Display System

|

└─ Communication System

- |
- └─ Control System
- |
- └─ Power System
- |
- └─ Maintenance Kit

第十四章

結論

地面控制站箱體不只是設備收納工具。

而是整個 UAV 指揮控制系統的核心平台。

優秀的 GCS 箱體應具備：

- ✓ 快速部署
- ✓ 快速收納
- ✓ 快速維修
- ✓ 高可靠度
- ✓ 模組化升級能力

當系統能在最短時間完成展開並投入任務時，地面控制站箱體便真正成為無人機系統的一部分。

HY Performing Case

Ground Control Station Deployment Solution

- * UAV Ground Control Station
- * Tactical Deployment Case
- * Military Communication Case
- * Command & Control Case
- * Rack Mount GCS System

MIT Taiwan Manufacturing
Non-China Supply Chain

Ground Control Station Case Design Guide

地面控制站箱體設計指南 (英文版)

Deployment-Ready Protection System

Introduction

As Unmanned Aerial Vehicle (UAV) operations continue to evolve toward long-range missions, real-time video transmission, multi-UAV coordination, and all-weather deployment, the Ground Control Station (GCS) has become the central command hub of the entire UAV ecosystem.

A modern Ground Control Station is no longer just a laptop combined with communication equipment. It is a fully integrated mission platform responsible for:

- * Command & Control
- * Mission Planning
- * Real-Time Monitoring
- * Communication Management
- * Data Processing & Storage

Therefore, Ground Control Station case design must go beyond equipment protection and focus on complete mission deployment capability.

Chapter 1

The Role of a Ground Control Station

Within a complete UAV system:

UAV System

|

├─ Flight Platform

├─ Payload System

├─ Communication System

├─ Power System

└─ Ground Control Station

The Ground Control Station serves as the primary command node.

Its functions include:

Flight Operations

- * Takeoff Control
- * Navigation
- * Landing Operations

Mission Monitoring

- * EO Camera Monitoring
- * Thermal Imaging
- * Night Vision Systems

Data Management

- * Flight Logs
- * Mission Records
- * GIS Data Integration

Communication Management

- * RF Communications
- * LTE / 5G Networks
- * Satellite Communications

Chapter 2

Typical Ground Control Station Components

Display System

Configuration:

- * Industrial Computer
 - * Rugged Laptop
 - * Industrial Monitor
-

Communication System

Configuration:

- * RF Modules
 - * Mesh Radio Systems
 - * LTE Routers
 - * Satellite Communication Devices
-

Power System

Configuration:

- * UPS Systems
 - * Battery Modules
 - * AC/DC Converters
-

Control System

Configuration:

- * Remote Controllers
 - * Control Panels
 - * Flight Joysticks
-

Chapter 3

Ground Control Station Design Principles

Principle 1

Open & Operate

The system should be mission-ready immediately after opening the case.

No field assembly should be required.

Principle 2

Rapid Deployment

Recommended deployment time:

Less than 5 minutes.

Principle 3

Equipment Integration

All mission-critical equipment should be permanently secured within the case.

Principle 4

Modular Design

Supports:

- * Maintenance
 - * Upgrades
 - * Future Expansion
-

Principle 5

Transportation Protection

Suitable for:

- * Ground Transportation
 - * Sea Freight
 - * Air Transportation
-

Chapter 4

Internal Architecture Design

Lid Section

Recommended Components:

- * Monitors
 - * Document Storage
 - * Antenna Storage Area
-

Main Equipment Section

Recommended Components:

- * Industrial Computers
 - * Rugged Laptops
 - * Control Equipment
-

Lower Equipment Section

Recommended Components:

- * Power Modules
 - * UPS Systems
 - * Cable Management Systems
-

Chapter 5

Display System Design

Single Monitor Configuration

Suitable for:

- * Small UAV Platforms
 - * FPV Systems
-

Dual Monitor Configuration

Suitable for:

- * VTOL UAVs

* Medium Fixed-Wing UAVs

Triple Monitor Configuration

Suitable for:

* Military Operations

* Multi-UAV Missions

Chapter 6

Communication Module Design

Compatible with:

RF Modules

Mesh Networks

LTE / 5G Networks

Satellite Communications (SATCOM)

Design Considerations:

* Thermal Management

* EMI Protection

* Rapid Replacement Capability

Chapter 7

Power System Design

Typical Configuration:

* AC Input

* UPS Backup

* Battery Backup

Design Goal:

Maintain operational capability for:

30–120 minutes during power outages.

Chapter 8

IP67 Protection Design

Ground Control Stations frequently operate in:

- * Rain
- * Dusty Environments
- * Coastal Areas

Recommended Protection Level:

IP67

- * Dustproof
 - * Waterproof
 - * Weather Resistant
-

Chapter 9

Shock Absorption & Foam Design

EVA Foam

Recommended for:

- * Displays
- * Computing Equipment

Advantages:

- * Excellent Appearance
- * Long-Term Durability
- * Precision Protection

EPE Foam

Recommended for:

- * Large Deployment Systems
- * Mass Production Projects

Advantages:

- * Lightweight
 - * Cost Effective
 - * Excellent Shock Absorption
-

ESD EVA Foam

Recommended for:

- * Electronic Modules
- * Communication Equipment
- * Sensitive Circuit Boards

Advantages:

- * Anti-Static Protection
 - * Electronics Safety
-

Chapter 10

Ground Control Station Categories

Type A

Portable GCS

Hand-Carry Configuration

Suitable for:

- * FPV Systems
 - * Small UAV Platforms
-

Type B

Mobile GCS

Wheeled Deployment System

Suitable for:

- * Medium-Scale UAV Operations
-

Type C

Tactical GCS

Military Tactical Configuration

Suitable for:

- * Defense Operations
 - * Tactical Missions
-

Type D

Rack-Mount GCS

19-Inch Rack System

Suitable for:

- * Command Centers
 - * Mobile Command Vehicles
 - * Communication Hubs
-

Engineering Development Process

Requirement Analysis



Equipment Measurement



System Layout Planning



Foam Engineering



Mechanical Design



Prototype Validation



Mass Production

Chapter 12

Non-China Supply Chain Strategy

HY Performing Case is committed to:

MIT Taiwan Manufacturing

Designed and manufactured in Taiwan.

Non-China Supply Chain

Supporting defense, government, and international procurement requirements.

Available Documentation:

- * Certificate of Origin (COO)
 - * Certificate of Conformity (COC)
 - * Material Traceability Reports
 - * Manufacturing Records
-

Chapter 13

Ground Control Station Deployment Architecture

Ground Control Station

|

├ Display System

|

├ Communication System

|

├ Control System

|

├ Power System

|

└ Maintenance Kit

Chapter 14

Conclusion

A Ground Control Station case is not merely a transportation container.

It is the operational core of the UAV Command & Control System.

An effective GCS deployment platform should provide:

- ✓ Rapid Deployment
- ✓ Rapid Recovery
- ✓ Easy Maintenance
- ✓ High Reliability
- ✓ Modular Upgrade Capability

When a system can be deployed and operational within minutes, the Ground Control Station becomes a true force multiplier for UAV missions.

HY Performing Case

Ground Control Station Deployment Solution

Specializing in:

- * UAV Ground Control Stations
- * Tactical Deployment Cases
- * Military Communication Cases
- * Command & Control Systems
- * Rack-Mount GCS Solutions

MIT Taiwan Manufacturing

Non-China Supply Chain

COO / COC Available

Deployment-Ready Protection System

Website:

HY Performing Case Official Website ☐