

IEEE Guide for Unmanned Aerial Vehicle-Based Patrol Inspection System for Transmission Lines

IEEE Power and Energy Society

Developed by the
Transmission and Distribution Committee

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Abstract: Demonstrated in this document are the UAV-based patrol inspection systems applied in operation and maintenance of transmission lines. The system compositions, application scenarios, functions and performance, test methods, and guidance for field applications are provided. This guide applies to the UAV systems used for patrol inspection on ac and dc overhead transmission lines.

Keywords: 3D ac, dc, IEEE 2821™, infrared thermal imager, inspection, LiDAR, multicopter, overhead line, patrol, powered fixed-wing plane, right-of-way, rotorcraft, scanner, single rotor helicopter, tower, unmanned aerial vehicle, visual camera

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Introduction

This introduction is not part of IEEE Std 2821-2020, IEEE Guide for Unmanned Aerial Vehicle-Based Patrol Inspection System for Transmission Lines.

Patrol and inspection of transmission lines are crucial to safe and reliable operation of power grids. As technologies evolve forward, unmanned aerial vehicles have already been used in a few countries to carry inspection devices to patrol and inspect transmission lines. Compared with foot patrol, the UAV-based patrol inspection is safer, and more efficient and effective while more types of data and records can be maintained. This guide is committed to providing basic but comprehensive information on UAV-based patrol inspection systems as guidance for their effective implementation in operation and maintenance (O&M) of transmission lines.

This guide first introduces the composition of UAV-based patrol inspection systems used for transmission lines. The application scenarios are presented, such as acceptance patrol inspection, routine patrol inspection, fault patrol inspection, and emergent patrol inspection. Main functions and performance requirements are discussed, while test methods are also recommended. Patrol inspection procedures are provided as guidance for field applications. In [Annex A](#), a use case is given to show a complete process in patrol inspection on a 500 kV ac overhead line.

Contents

1. Overview	10
1.1 Scope	10
1.2 Purpose	10
1.3 Word usage	10
2. Normative references	11
3. Definitions, acronyms, and abbreviations	12
3.1 Definitions	12
3.2 Acronyms and abbreviations	12
4. System composition	13
4.1 Overview	13
4.2 UAV	13
4.3 Ground control station	14
4.4 Communication unit	14
4.5 Payload	14
4.6 Data processing and analysis module	16
4.7 Optional accessories	16
5. Applications	16
5.1 Scenarios	16
5.2 Detailed patrol inspection	17
5.3 Patrol inspection on rights-of-way	18
6. Functions and performance	18
6.1 Overview	18
6.2 UAV	19
6.3 Payload	19
6.4 Flight and control	20
6.5 Flight safety	21
6.6 Environmental adaptability	23
6.7 Electromagnetic compatibility	23
6.8 Transportability	23
7. Tests	23
7.1 Test types and items	23
7.2 General considerations	25
7.3 Test methods	26
8. UAV-based patrol inspection procedures	32
8.1 Overview	32
8.2 Process of patrol inspection	32
8.3 Offsite preparation	33
8.4 Onsite execution	33
8.5 After the event	35
Annex A (informative) A use case	36
Annex B (informative) Bibliography	46

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1. Overview

1.1 Scope

This guide addresses the composition, general technical requirements, testing method, and testing rules of UAV-based patrol inspection systems.

This guide applies to the UAV systems used for patrol inspection on ac and dc overhead transmission lines.

1.2 Purpose

Patrol inspection on transmission lines is an arduous task involving high electrical safety risks, harsh working environments, and high workloads. The UAV-based patrol inspection is safer and easier than foot patrol inspection to identify the defects and risks in transmission lines and the surrounding environment. With optimized system functions and performance, UAV-based patrol inspection could realize high inspection quality, consistency, efficiency, and coverage. The purpose of this guide is to provide information on the system composition, applications, functions and performance, test methods, and operational procedures of the UAV-based patrol inspection system for overhead transmission lines, and thus help utilities to choose and use the right inspection system for a specific application.

1.3 Word usage

The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (shall equals is required to).^{1,2}

The word *should* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (should equals is recommended that).

The word *may* is used to indicate a course of action permissible within the limits of the standard (may equals is permitted to).

¹The use of the word *must* is deprecated and cannot be used when stating mandatory requirements, *must* is used only to describe unavoidable situations.

²The use of *will* is deprecated and cannot be used when stating mandatory requirements, *will* is only used in statements of fact.