A COMPARATIVE ANALYSIS OF UAV STANDARDS FOR ENHANCED SAFETY INSPECTION IN CHEMICAL PROCESSING

Saiful Izwan Bin Safie

OUTLINE

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Comparison Of UAV Standards

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Discussion

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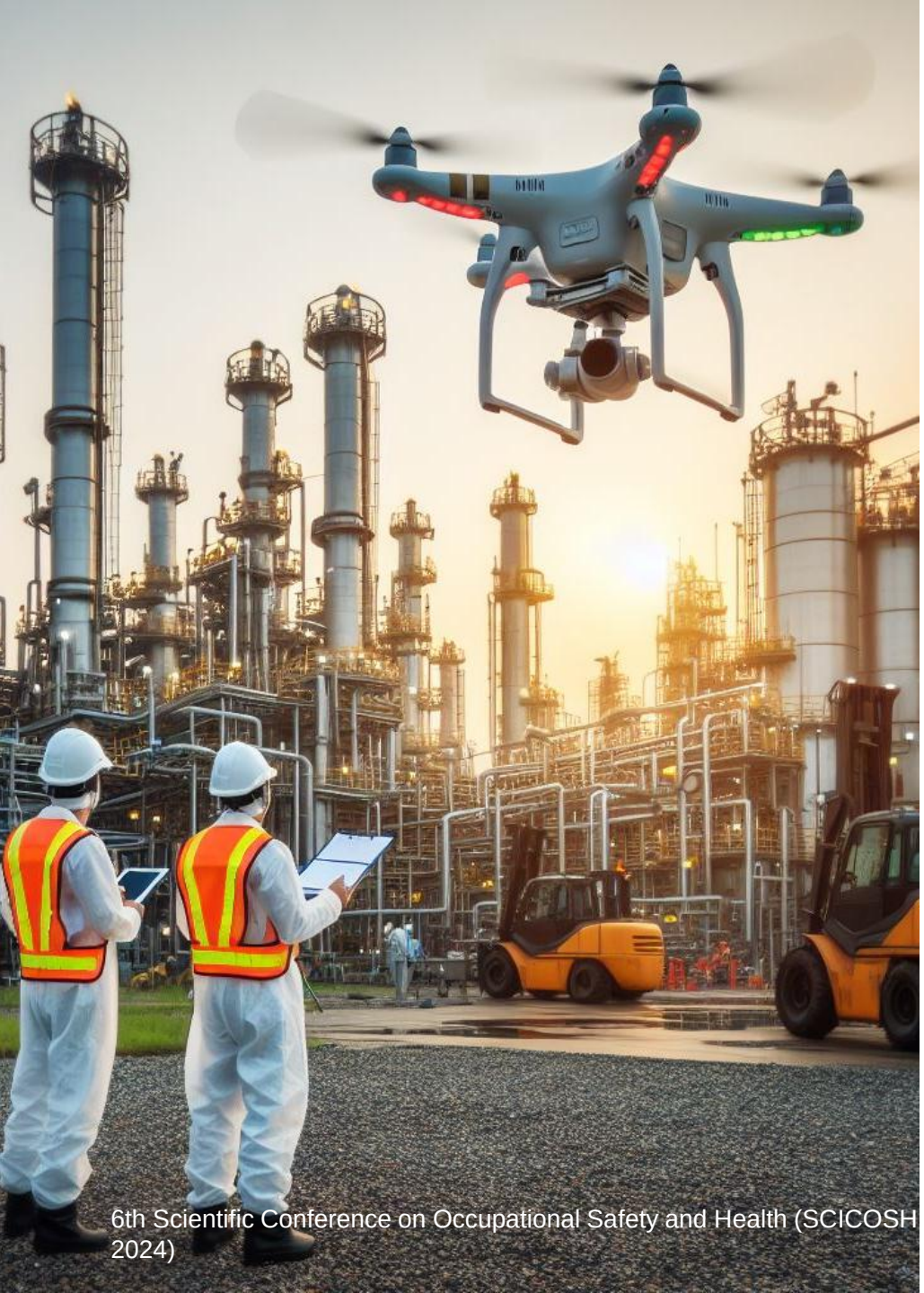
INTRODUCTION

Importance of Safety Inspections:

- Essential for preventing accidents and upholding worker/environmental safety.
- Early identification of hazards and adherence to regulations (Edwards & Study, 2018).
- Malaysian chemical sector incidents emphasize robust safety management (Ajmal et al., 2022).

Challenges and Needs:

- High accident rates in Malaysian chemical manufacturing (Zakaria et al., 2019).
- Need for enhanced safety climate and risk analysis.
- Focus on process safety advancements (automation, digitalization).

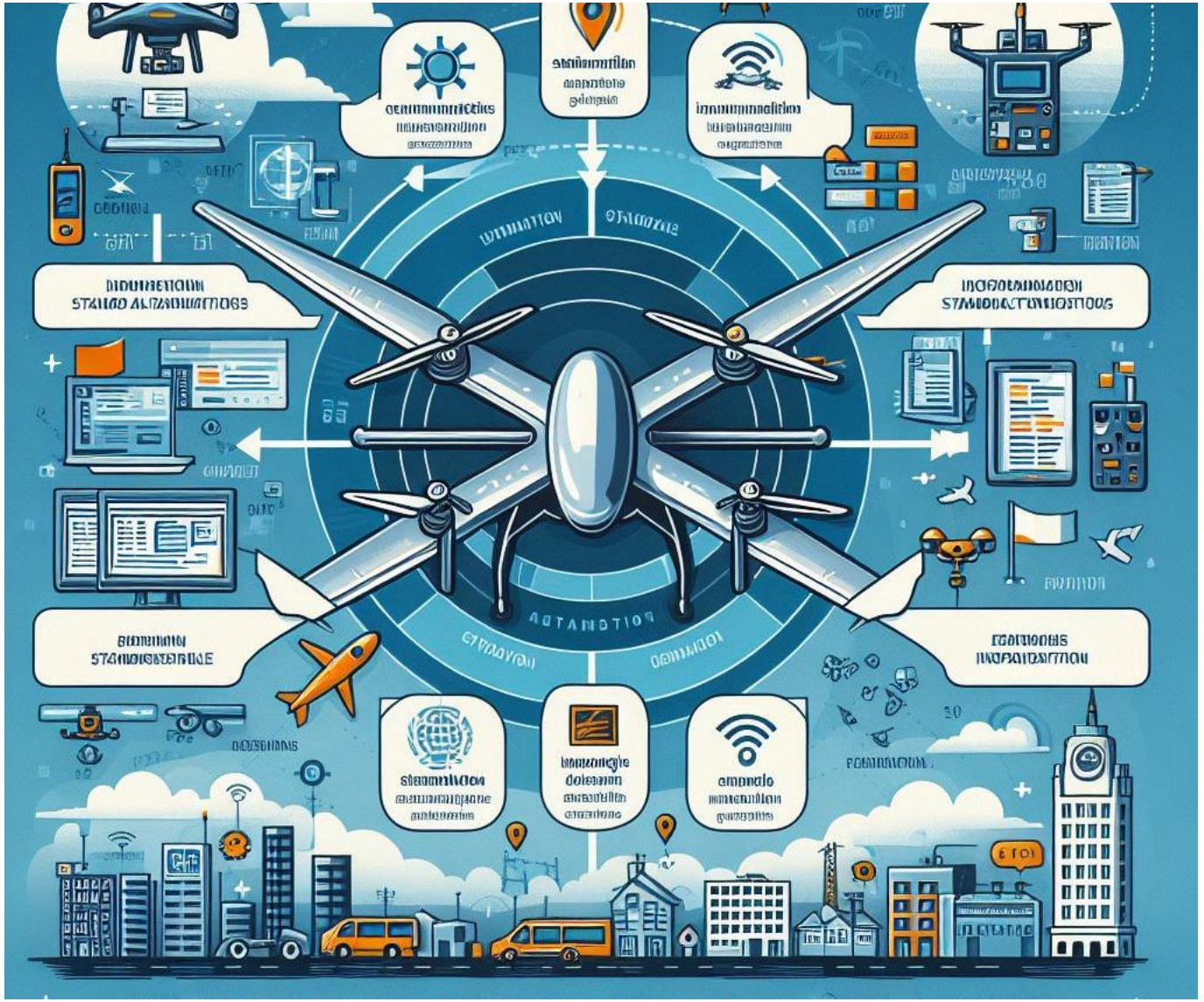


DRONES AS A TRANSFORMATIVE TECHNOLOGY:

- Increased accessibility to challenging areas (Nooralishahi et al., 2021).
- Enhanced time efficiency and reduced safety risks for personnel.
- Equipment inspection as a key application (flare stacks, vessels).
- Internal asset inspection reduces downtime, costs, and risks.
- Versatile applications: emergency response, security, surveys, remediation.

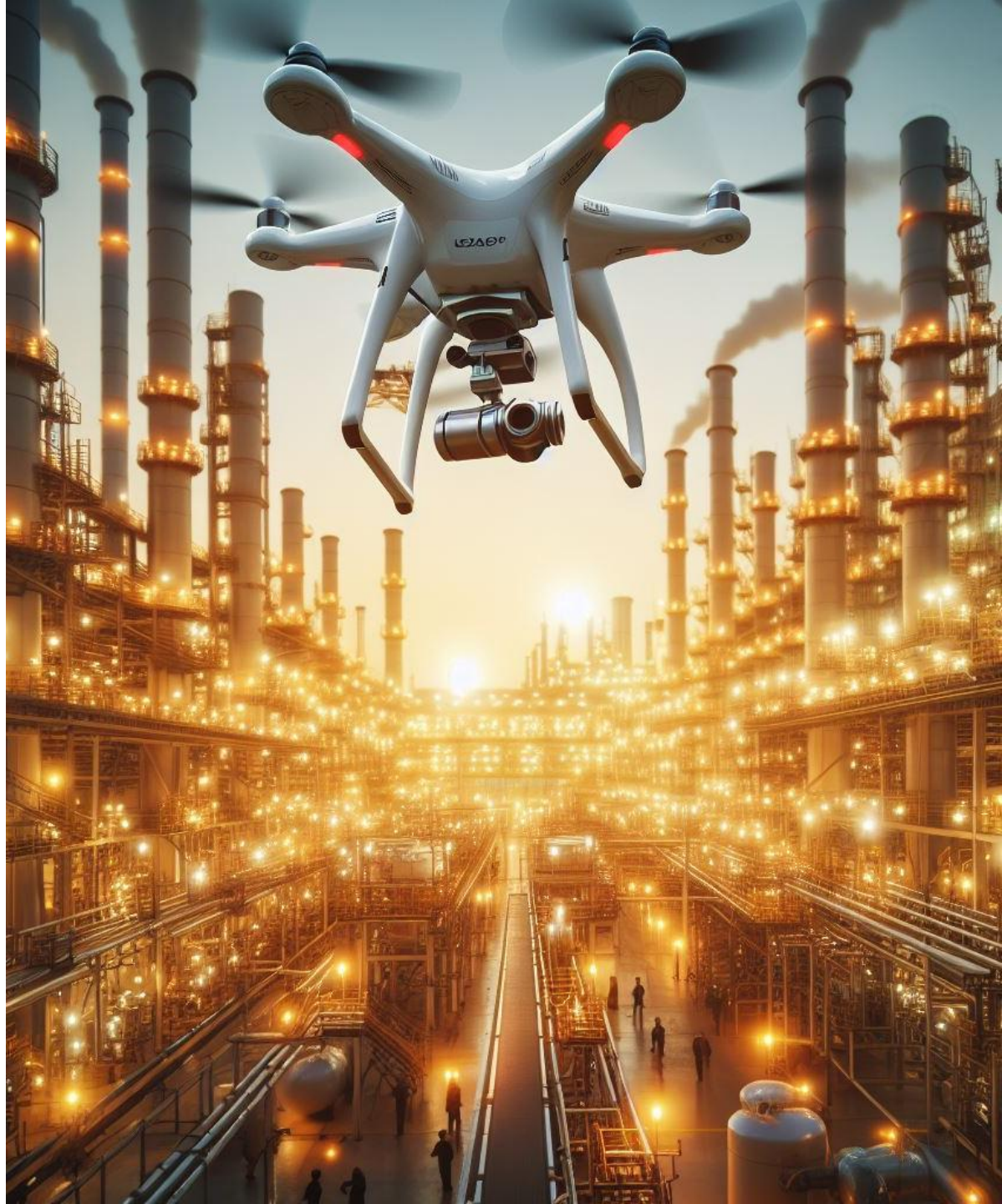
ADDRESSING THE STANDARDIZATION GAP:

- Lack of industry-wide standards for drone use in chemical plants.
- Need for overarching standards tailored to unique plant requirements.
- This paper assesses existing standards and their applicability.
- Aims to establish standardized practices for enhanced safety and effectiveness.



UNMANNED AERIAL VEHICLE (UAV) STANDARDS

- International Civil Aviation Organization (ICAO)
- European Union (EU) and European Aviation Safety Agency (EASA)
- United States (US) and Federal Aviation Administration (FAA)
- Japan
- Malaysia and Civil Aviation Authority of Malaysia (CAAM)



UNMANNED AERIAL VEHICLE (UAV) STANDARDS

International Civil Aviation Organization (ICAO)

- **Goal**: Safe integration of UAVs into global airspace
- **Regulations**: Public safety, liability, societal benefits, ethical considerations
- **Compliance**: Aligned with manned aircraft rules and obligations
- **Focus**: Remotely piloted aircraft systems (RPAS) with limited autonomy
- **Key document**: Circular 328 AN/190 - Unmanned Aircraft Systems (UAS)

European Aviation Safety Agency (EASA)

- **Key agency**: EASA - responsible for safety of civil aviation in Europe
- **Regulations**: Comprehensive, risk-based, no distinction between leisure/commercial
- **Categories:** Open (low risk), Specific (higher risk), Certified (highest risk)
- **Emphasis**: Safety, security, environmental sustainability
- **Key document**: EU Regulation 2019/947

UNMANNED AERIAL VEHICLE (UAV) STANDARDS

Federal Aviation Administration (FAA)

- **Key agency**: FAA - regulates all facets of civil aviation, including UAS
- **Regulations**: 14 CFR Part 107 for small UAS under 55 pounds
- **Focus:** Public safety, privacy, compliance with manned aircraft rules
- **Distinction**: Recreational vs. commercial use (permits, certification)
- **Impact:** Training, qualification standards for UAV pilots and operators

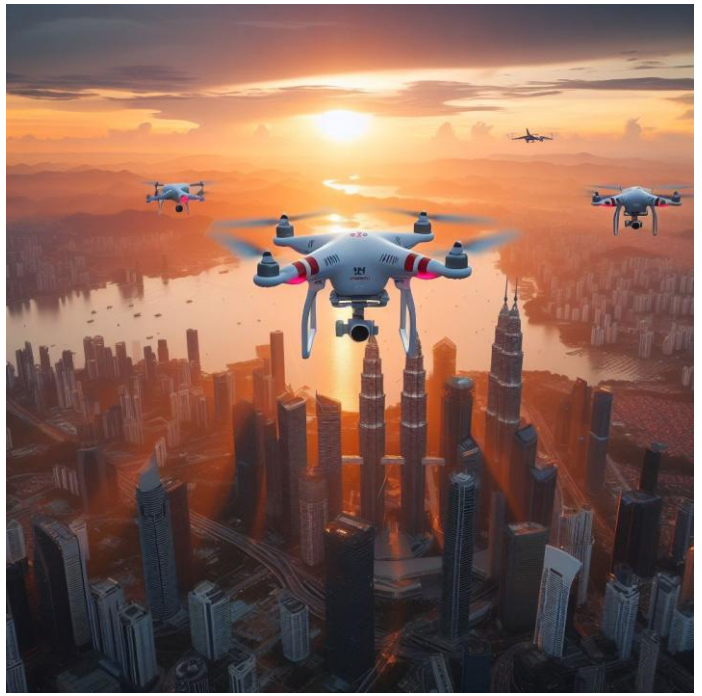
Japan

- **Regulations**: Comprehensive, registration required for 100g+ UAVs
- **Flight permission**: Needed for specific airspaces and conditions
- **Focus:** Safety, disaster preparedness, environmental research
- **Challenges:** Room for improvement, local government influence
- **Development**: Automatic systems for UAV motion control in specific environments

UNMANNED AERIAL VEHICLE (UAV) STANDARDS

Malaysia and Civil Aviation Authority of Malaysia (CAAM)

- **Regulations**: Aligned with ICAO, focus on compliance and safety
- **CAAM approvals:** Authorization To Fly (ATF), Certificate of Approval (COA)
- **Operator guidelines:** Visual line of sight, restricted airspace, altitude limits
- **Permits:** Required 14 days before flight, fees vary based on weight
- **Challenge:** Recent downgrade by FAA emphasizes importance of adherence to regulations



COMPARISON OF UAV STANDARDS

Feature	ICAO	EASA	FAA	LBA	MLIT	CAAM
Airspace Regulations	Authorized citizen airspace	Prohibited above 250g	Restricted over citizens, prohibited in specific areas	Prohibited above 250g	Authorized with 30m separation	Authorized with 50m separation
Night Flight & Dangerous Goods	Authorized	Green flashing lights	Recommended lighting aids, deferral to Hazardous Materials Safety	Prohibited	No specific regulations	No specific regulations
Operational Limitations	Max altitude 400ft (121m)	Max altitude 120m	Max altitude 400ft	Max altitude 100m (<5kg), Prohibited above 100m (>5kg)	Max altitude 150m	Max altitude 400ft
Registration	All drones	Above 250g with camera/sensor	All drones	Above 249g or below 250g with camera	All drones	Above 20kg
Prior Authorization	Certain areas	Certain areas	Class B, C, D, and E airspaces	Restricted areas	Restricted areas	Specific areas
Operator Qualification	Min. age 16	Min. age 16	Min. age 16	Min. age 16	No min. age	Min. age 18
Pilot Certification	Recommended	Specific & Certified categories	Remote pilot license	Remote pilot competency cert.	Unmanned aircraft remote pilot cert.	Remote pilot certificate of competency (RCoC)

AMERICAN PETROLEUM INSTITUTE (API) UAV GUIDELINE

Focuses on key considerations for UAV programs

- Data protection
- Standard operating procedures
- Contingency planning
- Risk management

Recommendations:

- Flight risk assessment tool
- Robust approval processes
- Tailored training for UAS operators

AMERICAN PETROLEUM INSTITUTE (API) UAV GUIDELINE

Highlights UAV importance in:

- Monitoring
- Surveillance
- Environmental protection

Emphasizes:

- Review of local, state, and federal regulations
- Compliance and responsible UAS use
- Wider accessibility of safety information and best practices

CONCLUSION

Challenges:

- Collisions, malfunctions, contamination risks
- Unauthorized UAV activity (espionage, eavesdropping, terrorism)
- Noise disturbances, potential collisions, trespassing (impacting communities)

Solutions:

- **Standardized protocols:**
  - Prioritize human safety, environmental protection, plant asset integrity
  - Risk assessments, operator training
- **Strong legal framework:**
  - Mitigate security risks (FAA regulations as example)
  - Respect privacy rights
- **Industry collaboration:**
  - API guidance for responsible UAV programs
  - Best practices and standards

Moving Forward:

- **Comprehensive UAV standards:**
  - Safety protocols, security measures, operational guidelines
  - Tailored to chemical processing needs
- **Balanced framework:**
  - Promote innovation
  - Prioritize safety & security
  - Enhance efficiency of safety inspections
  - Increase resilience and sustainability of chemical plants

SAIRUL IZWAN SAFIE

sairulizwan@unikl.edu.my

THANK YOU