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中国民用航空局
空中交通管理局
Air Traffic Management Bureau, CAAC

ICAO Asia/Pacific Regional Webinar
Implementation of ATM Automation System in APAC Region
7th June 2022 (Indochina Time, UTC+7)

Practice Sharing of A-SMGCS Lighting Guidance Application in China

Presented by China

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1. Background

Guided by controllers' calls

Guided by Follow-me Vehicle

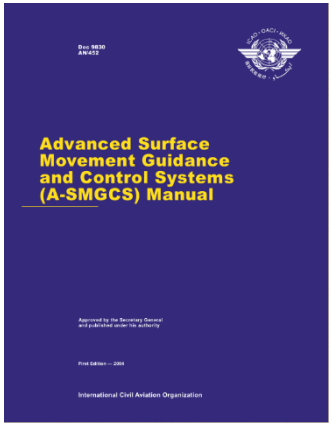
- Heavy workload
- Error-prone
- Low efficiency
- Conflict risks
- Low capacity

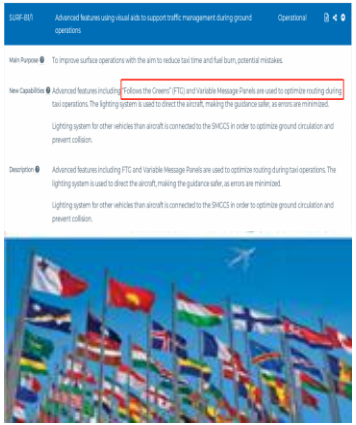
Increasing large, complex and busy airports

More obvious in low visibility

1. Background

- ICAO DOC 9830 recommends that A-SMGCS Level IV adopts lighting guidance to guide aircraft taxiing .
- ICAO DOC 9750: ASBU SURF-B1/1 recommends “Follows the Greens” (FTG) to optimize routing during taxi operations.
- After more than ten years of research and verification of A-SMGCS lighting guidance, CAAC has applied it in Beijing Daxing International Airport in 2019 to realize all-weather lighting guidance, reaching the operation standard of A-SMGCS Level IV .





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2. Solutions

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Standard specifications

Operating regulations

Surveillance process

Routing

Conflict detection

Fusion track

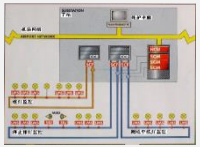
Taxing route

Conflict alert

Guidance control

Light control instructions

Light status



ILCMS
(Individual light control and monitoring system)

Taxiway center line lights
Stop bars

A-SMGCS

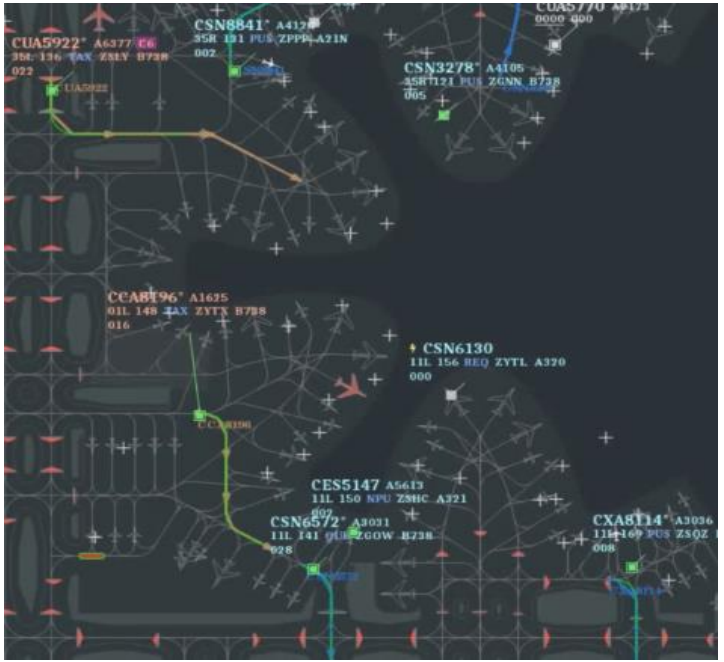
SMR

MLAT

SSR

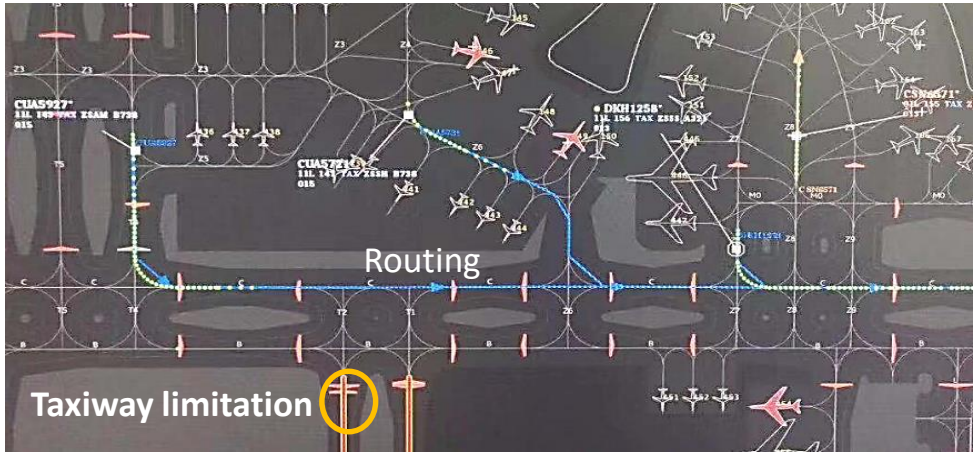
(1) Accurate Surveillance Signals Covering the Whole Surface

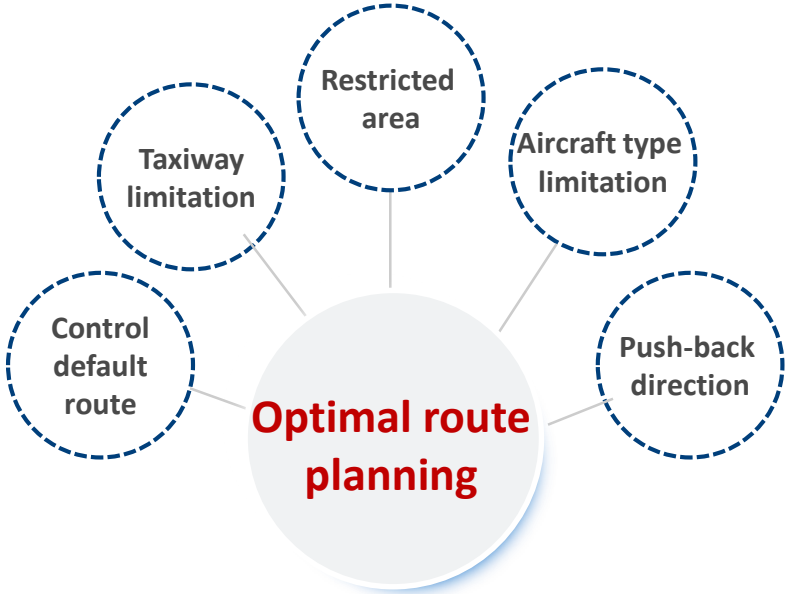
- Construction of SMR, MLAT, etc. covering the entire surface of the aerodrome;
- A-SMGCS fuses surveillance source data to form accurate (accuracy of 7.5m), continuous and stable synthetic track data covering the entire surface.



(2) Routing

- Based on the control operation rules and limitations, adopting intelligent algorithm to automatically plan the optimal taxi route for aircraft;
- Supporting manual planning and modification.



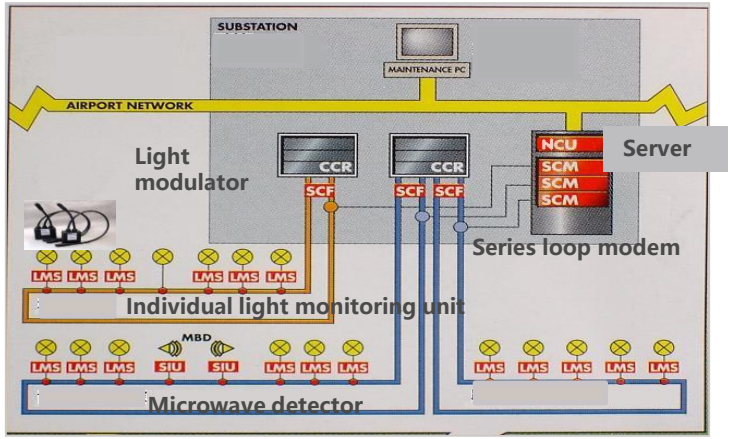


Dijkstra algorithm etc.

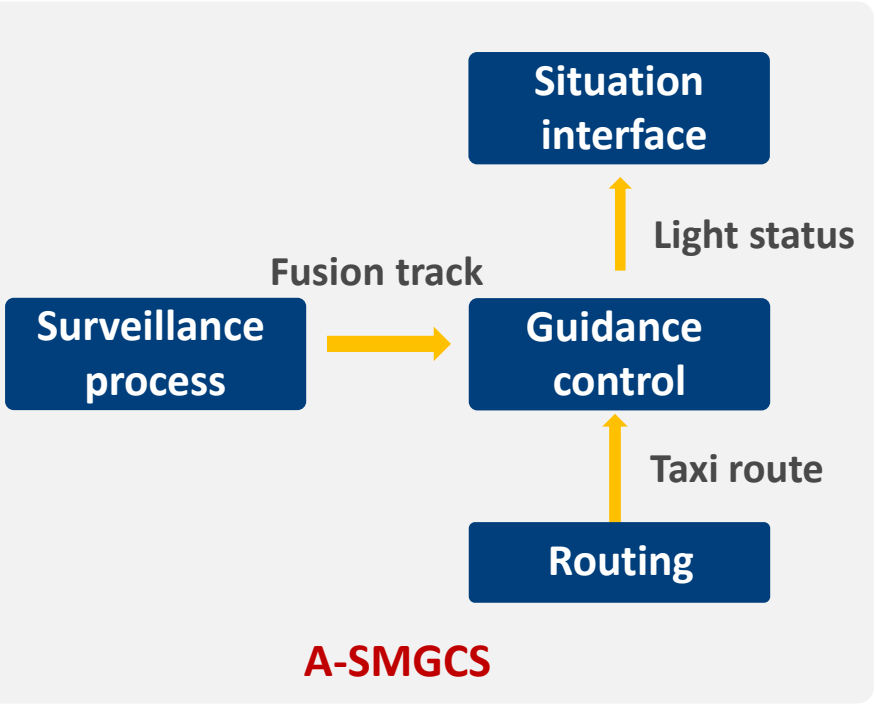
(3) ILCMS --- Basis for Lighting Control

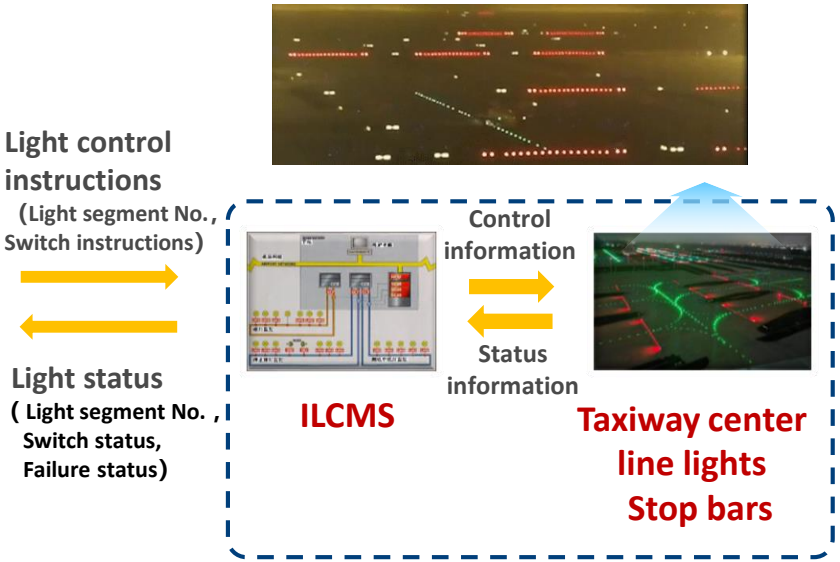
ILCMS that can interact with A-SMGCS is constructed by the aerodrome side, and the aerodrome surface can be controlled by an individual light or a light segment:

- Taxiway center line lights;
- Stop bars （Deployed at taxiway intersections and runway access points）.



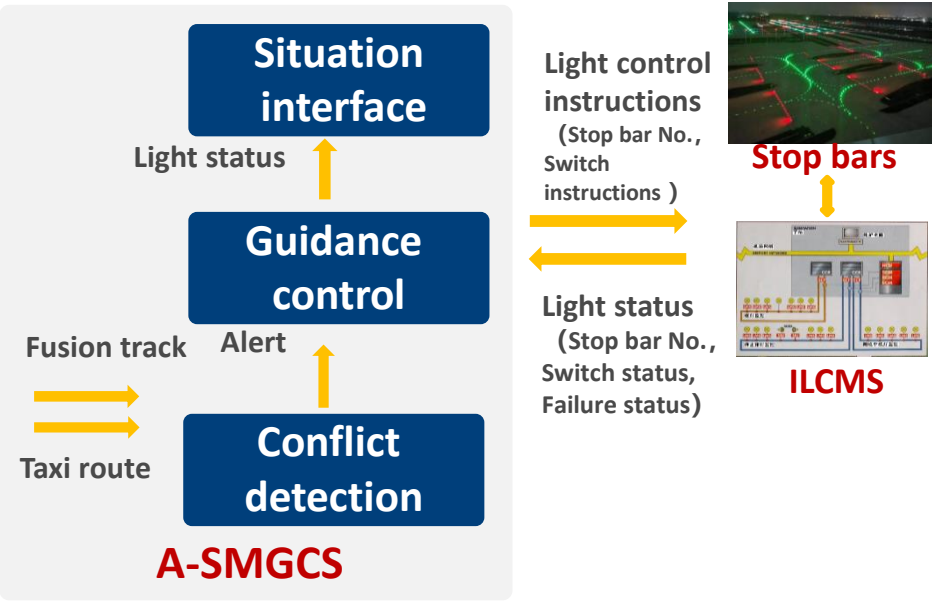
(4) Lighting Guidance Instruction Generation and Interactive Control

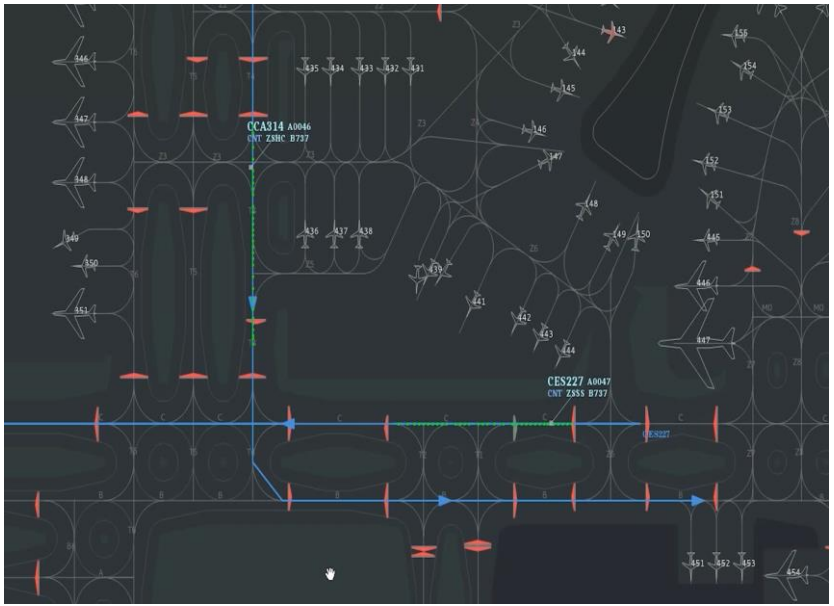




(5) Conflict Resolution During Taxing

Conflict detection and resolution technology is applied to realize conflict resolution during aircraft taxiing while a conflict occurs.





(6) Formulating Standards and Operating Regulations

- In 2019, Standard MH/T 4042-2014 of CAAC was revised to form **Technical Requirements for A-SMGCS** to regulate the technical requirements for lighting guidance.
- In 2021, the A-SMGCS lighting guidance test certification was implemented, and then the **A-SMGCS Level IV official license** was issued.
- ATMB and airports jointly formulated **operation regulations of lighting guidance** to ensure the smooth operation of lighting guidance.

民航明传电报

签报盖章 许浩

等级 特急 局发明电〔2019〕1109号

关于下发《高级场面活动引导与控制系统技术要求（试行）》的通知

民航各地区管理局，各机场公司，各地区空管局：

为进一步推进高级场面活动引导与控制系统（以下简称A-SMGCS系统）民航应用，确保系统建设实施与开放运行安全，为各运输机场 A-SMGCS 系统使用许可，工厂验收，现场验收等测试工作提供指导，我办组织对行业标准《高级场面活动引导与控制自动化系统技术要求》(MH/T 4042-2014)进行了修订和完善，重点增加了对A-SMGCS III/IV 级系统路由规划，引导等功能的要求，现下发行业试行，请各单位遵照执行，并在试行过程中及时反馈相关意见与建议，确保规范不断完善。

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CAAC

民用航空空中交通通信导航监视设备

使用许可证

CERTIFICATE OF APPROVAL

证书编号：

CERTIFICATE NO.: Z-S-(A-SMGCS)-(Dublhc-2000)-LES

设备生产厂家：南京莱斯信息技术股份有限公司

MANUFACTURER: NANJING LES INFORMATION TECHNOLOGY CO., LTD.

设备类型：高级场面活动引导与控制系统

EQUIPMENT TYPE: Advanced Surface Movement Guidance and Control System

设备型号及产地：大场-2000 中国

MODEL AND ORIGIN: Dublhc-2000 China

根据《民用航空空中交通通信导航监视设备使用许可管理办法》（CCAR-87）及有关规定要求，经审查，该设备符合取得民用航空空中交通通信导航监视设备使用许可证条件。

特发此证，以昭证明。

THIS IS TO CERTIFY THAT THE EQUIPMENT MENTIONED ABOVE COMPLIES WITH THE CIVIL AVIATION CNS EQUIPMENT CERTIFICATION RULES (CCAR-87) AND RELEVANT PROVISIONS, AFTER NECESSARY REVIEW AND TEST.

颁发日期：2021 年 08 月 29 日

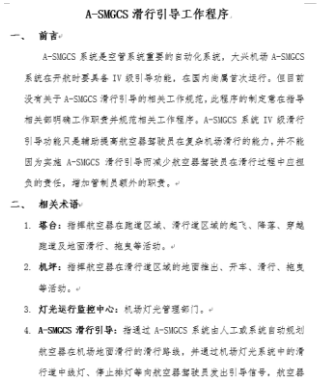
DATE OF ISSUE:

有效期至：2026 年 08 月 28 日

VALID UNTIL:

发证机关：

AUTHORIZED BY:



A-SMGCS 滑行引导工作程序

一、 前言

A-SMGCS 系统是空管系统重要的自动化系统，大兴机场 A-SMGCS 系统在开航时具备 IV 级引导功能，在国内尚属首次运行。但目前没有关于 A-SMGCS 滑行引导的相关工作规范，此程序的制定意在指导相关部明确工作职责并规范相关工作程序。A-SMGCS 系统 IV 级滑行引导功能只是辅助提高航空器驾驶员在复杂机场滑行的能力，并不能因为实施 A-SMGCS 滑行引导而减少航空器驾驶员在滑行过程中应担负的责任，增加管制员额外的职责。

二、 相关术语

1. **塔台：**指挥航空器在跑道区域、滑行道区域的起飞、降落、穿越跑道及地面滑行、拖曳等活动。
2. **机坪：**指挥航空器在滑行道区域的地面推出、开车、滑行、拖曳等活动。
3. **灯光运行监控中心：**机场灯光管理部门。
4. **A-SMGCS 滑行引导：**指通过 A-SMGCS 系统由人工或系统自动规划航空器在机场地面滑行的滑行路线，并通过机场灯光系统中的滑行道中线灯、停止排灯等向航空器驾驶员发出引导信号，航空器

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3. Application Case

On September 25, 2019, **Beijing Daxing International Airport** came into service and started **the all-day and all-weather lighting guidance** of A-SMGCS Level IV.

3. Application Case

(1) Project Construction and Operation Preparation

2017.11

Started construction of the A-SMGCS project.

From May to June 2019
- on-site installation,
- joint test after surveillance source access;
- running-field test.

Supporting construction
- 3 SMRs;
- 3 ADS-Bs;
- 44 MLATs.

Supporting construction ILCMS and navigational lighting aid (over 4000 light segments, over 20000 lights)

In July 2019,
- joint test with ILCMS
- lighting guidance function verification

In August 2019, CAAC tested the lighting guidance system, issued the Temporary License of A-SMGCS Level IV, formulated lighting guidance operation regulations.

In August 2019, participated in 3 flight tests, including CAT IIIB flight test, with operation capability of low visibility of RVR75m

2019.9.25

Started A-SMGCS lighting guidance operation

(2) Application Effect

Continuous all-weather operation

- **All-weather** operating for continuous **3 years**;
- Guidance days accounting for **99.5%** of the total days;
- Proportion of guided flights: **> 99%**;
- Max. number of guided flights in a single day: > 800.

Operation in low visibility

- **43 low-visibility** operations, total **148hrs**;
  (up to November 2021)
- Total 1,699 flights take-off and landing;
- **RVR175m** take-off and landing **with passenger on-board** .

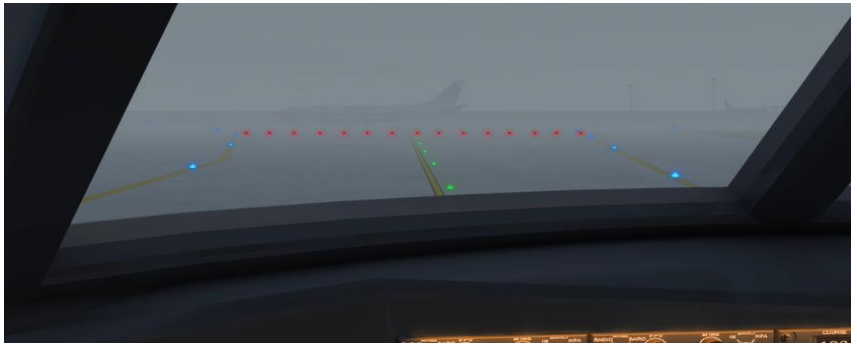
(2) Application Effect

Improving operation efficiency

- Reduce call volume and workload ;
- Reduce error rate;
- Improve taxiing guidance safety and efficiency;
- Improve operation capacity and safety under
- Low visibility conditions;
- Replace follow-me vehicles, reduce running cost.

CCA101, **Taxi follow green light** hold short of T4

Taxi follow green light hold short of T4 , CCA101



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4. Construction and Operation Advices

1. As surveillance data are the basis of lighting guidance, a sufficient number of SMRs and MLATs should be deployed in advance, and the system testing should focus on the full coverage, accuracy and stability of the surveillance data.

2. ILCMS should be accomplished before the A-SMGCS.
   Light segments should be coordinated and reasonably planned by ATMB, aerodrome, and lighting manufacturer to improve the efficiency of lighting guidance.

4. Construction and Operation Advices

3. The light response loop time is controlled within 3 seconds. If the response loop time is too long, it will limit the taxiing speed of the aircraft and the timeliness of conflict resolution which may lead operational risks.

4. Before official operating, sufficient time should be reserved for aircraft lighting guidance test to verify the quality of surveillance signals and the correctness of the lighting guidance function.

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5. Summary and Outlook

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The promotion of A-SMGCS lighting guidance operation at Beijing Daxing International Airport by CAAC is an in-depth exploration and practice of the standard of ICAO DOC 9830 operation concept of lighting guidance.

The A-SMGCS Level IV lighting guidance operation in China will provide experience for Authorities to promote the construction and implementation of A-SMGCS Level IV lighting guidance, and provide support for the implementation of ICAO ASBU to improve the safety and efficiency of surface operations.

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Thanks!