



中國民航總局第二研究所
THE SECOND RESEARCH INSTITUTE OF CAAC



The Practice Of Runway Incursion Prevention In Tower ATM Automation System



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OVERVIEW

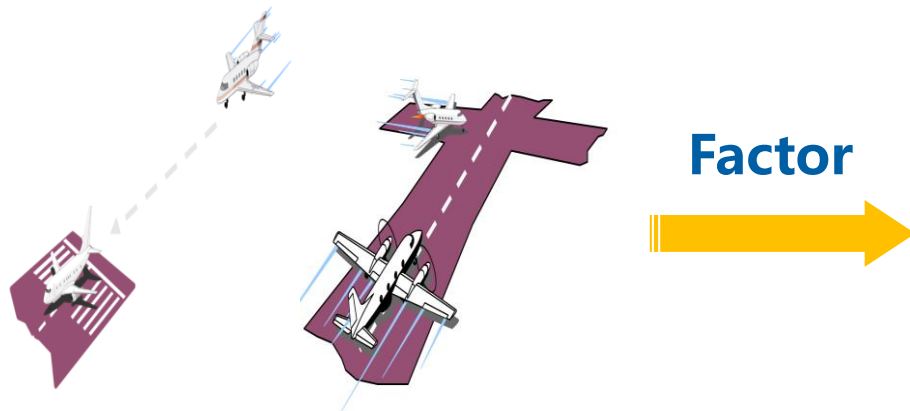


PART ONE



Definition in ICAO Doc 9870 AN/463

Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take off of aircraft.



ATC controller	Wrong instruction from controller
Pilot	Any violation of procedural rules by the pilot
Vehicle driver	Enter the runway safety area without controllers' authorization



**Tenerife Disaster, 1977
Accident**



**Hongqiao Airport, 2016
Serious Incident**

**Equipment
Reason**

A

**Difficult to establish common
situational awareness for
controllers, pilots and pilots**

B

**Lack of effective
monitoring & safety
detection technical
means**

C

**Decentralized and independent
tower operation system**





Available Technologies





HUD



Stop Bar



RWSL



For Controller



play Maps Windows Target Alert 02L ALL 02R ALL Lower OFF Upper OFF SSR OFF 1002 Auto Range 2.59 KM 103° 56' 27.75" E 30° 31' 15.633" N OPERATIVE ALLNETWORK NORMAL CPW06 TWREC X_TWR2 SL02 GND2 GND3

SL_CWP06 角色: TWREC 席位: X_TWR1 (GND3 SL02 DLV1)

02L DEP 02R ALL D-ATIS: S D-QNH: 1004 A-QNH: 1004 UTC: 06:21:52 OPERATIVE AUTONOMOUS NORMAL

A/G Distance Inset #1 ILS #1 ApprView Finder Full Label

Inset #1
RC NC 3856
CTL CCA1234 ZZZZ
1.5km

Alarm Infos

No.	Target	Type	Info	Time
1	ZH2345 CCA1234	RC	POSSIBLE COLLISION IN 199	07:12:21
2	ZH2345	RI	UNKNOWN ON RWY	07:12:30
3	CCA1234	NC	NO LND	07:12:16

PRE(26)

0256	CCA8222	ZHHH	A320/M	302	0625	REQ
0355	CES2643	ZHYC	B738/M	316L	0725	REQ
0430	CXA8424	ZSHC	B738/M	302	0645	REQ
0456	CSN3765	ZGSD	B738/M	126	0639	REQ
0600	CES5414	ZSPD	A320/H	134	0614	REQ
0605	TBA8933	ZGSZ	A320/M	159	0619	REQ
0605	CES5416	ZSSS	A322/H	147	0619	REQ
0610	UEA2273	ZLLL	A320/M	143	0630	REQ
0610	CES5846	ZPPP	B737/M	157	0624	REQ
0610	CSC8917	ZSHC	A321/M	120	0625	REQ
0615	CSN6256	ZYHB	A520/M	136	0630	REQ
0615	CSZ9568	ZSNJ	B738/M	168	0637	REQ
0615	DKH1088	ZSSS	B789/H	132	0630	REQ
0620	CCA4470	ZLHZ	A320/M	160	0620	RFD

RDY/NPL(5)

RDY	CSZ9542	A7450	02L	MMM	NPL
RDY	ZSWX	B738/	160	0325	0503
RDY	CCD8972	A7453	02L	SD12	NPL
RDY	ZYTL	B738/	0325	0345	
RDY	CES2218		02R	SD28	NPL
RDY	ZLYS	A319/M	139	0530	0543
RDY	CSC8113E		02R	SD28	NPL
RDY	ZYHB	A308/H	118	0250	0305
RDY	CBJ5178	A7405	02R	SD26	NPL
RDY	ZJSY	A306/H	146	0255	0310

CTL(0)

FCL(71)

类型: 全部 限制名称:

CDM系统 人工

1. 7日ZULS 限制间隔 10分钟(TIME)
2. ZUNZ 限制间隔8分钟(TIME)
3. ZULS 限制间隔 5分钟(TIME)
4. ZURK 限制间隔 10分钟(TIME)
5. ZUBD 限制间隔 10分钟(TIME)
6. 武义区域以远6分钟(TIME)
7. 0127方向 ZSNJ,ZSNJ,ZSGS,ZSID,ZSSR,ZSWY,ZSIU,ZSAQ... 限制间隔 6分钟(TIME)
8. WHA ZSNJ,ZSNJ,ZSWX,ZSCG,ZSYA,ZSSH,ZSAQ,ZSOF... 限制间隔 6分钟(TIME)
9. LLC ZSHC 限制间隔 15分钟(TIME)
10. 7月 LLC ZSSS,ZSPD,ZSHC,ZSWY,ZSNB,ZSWZ,ZSLQ,ZSZS 限制间隔 7分钟(TIME)
11. AGULU,ZHCC 限制间隔 100km(TIME)
12. 7月 LLC ZSSS,ZSPD,ZSHC,ZSWY,ZSNB,ZSWZ,ZSLQ,ZSZS 限制间隔 7分钟(TIME)
13. LLC ZSHC 限制间隔 15分钟(TIME)
14. WHA ZSNJ,ZSNJ,ZSWX,ZSCG,ZSYA,ZSSH,ZSAQ,ZSOF... 6分钟(TIME)
15. 7月 LLC ZSSS,ZSPD,ZSHC,ZSWY,ZSNB,ZSWZ,ZSLQ,ZSZS 限制间隔 7分钟(TIME)
16. LLC ZSTX,ZSAQ,ZSIJ,ZSWY,ZSSR,ZSIU,ZSSM,ZSAM... 限制间隔 10分钟(TIME)

离场跑道 起始高度 移交APP扇区/频率

02L	S0120	AP01 (111.09)
02R	S0180	AP65 (111.21)

SD11, SD18B, SD12, SD14, SD16, SD21, SD26, SD22, SD24, SD26

查询 获取计划! CD ATC 进程单 相邻席位 流量限制管理 VIP管理 系统设置 日志 登录

A-SMGCS

EFS



SOLUTION



2

PART TWO



塔台管制自动化系统技术要求及配置规范 (试行)

民航明传电报

发电单位 民航局空管办、空管局 签发盖章 许浩 李其国
等级 加急·明电 局发明电〔2020〕2921号

关于推进塔台管制自动化系统建设应用 工作的意见

民航各地区管理局，各机场公司，各地区空管局：

塔台管制自动化系统是通过空管数据融合处理及集成联动提升管制运行效率的重要综合信息系统。民航局高度重视应用新技术提升中国民航运行效能，为进一步理顺并做好塔台管制自动化系统建设和应用工作，提升空中交通及机场场面运行安全、效率和容量，经研究，提出如下意见。

一、系统功能与组成

塔台管制自动化系统是塔台管制指挥使用的计算机综合系统，具有飞行计划数据处理、电子进程单、场面和空中监视数据处理、告警、路由规划、引导、数字空管放行、数字通播信息处理，以及流量管理、停机位、气象、情报信息处理显示等功能。

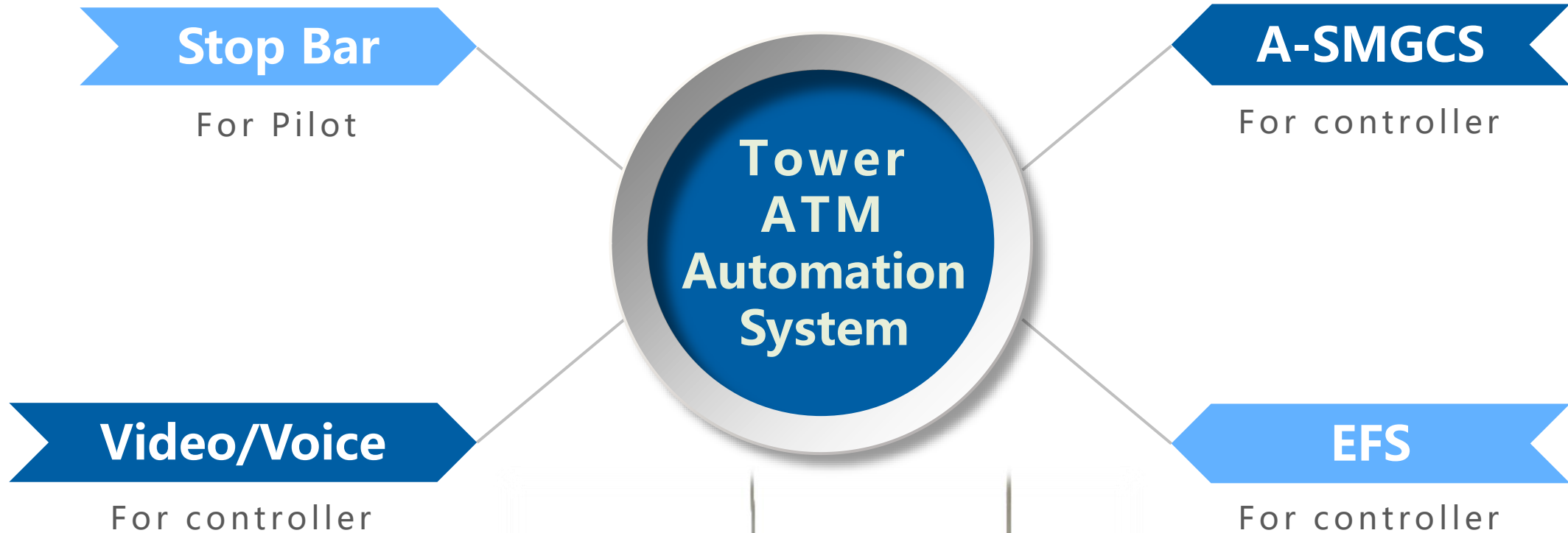
局空管行业管理办公室
空管局空中交通管理局
二〇年十一月

- **Published Technical Requirement and Configure Specification of Tower ATM Automation System.**
- **Provide differentiated and efficient integrated work interface for different airport traffic.**



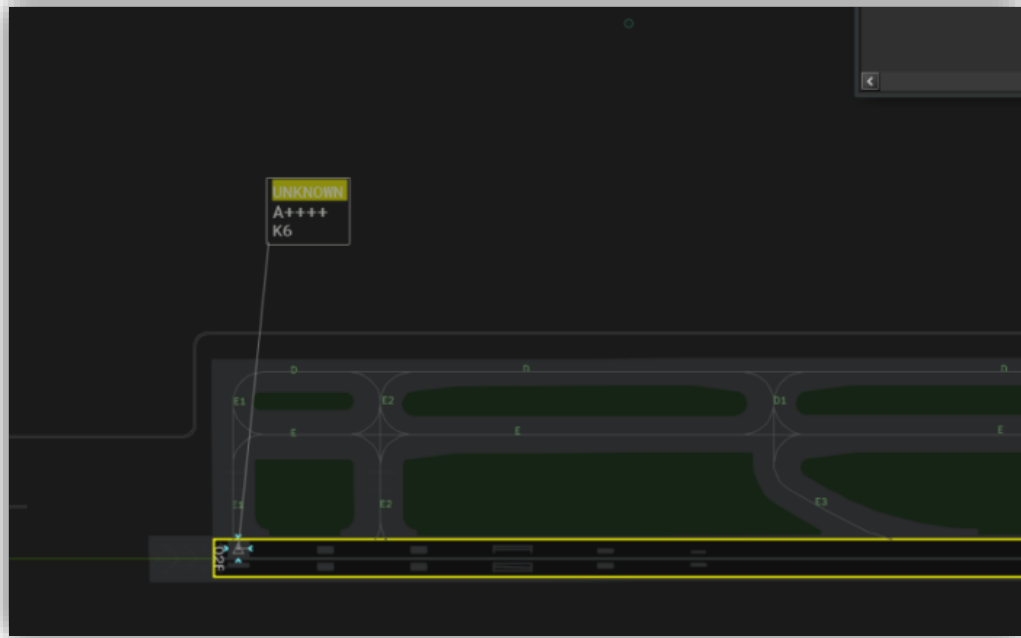


Integrate RIP Function into Tower ATM automation system

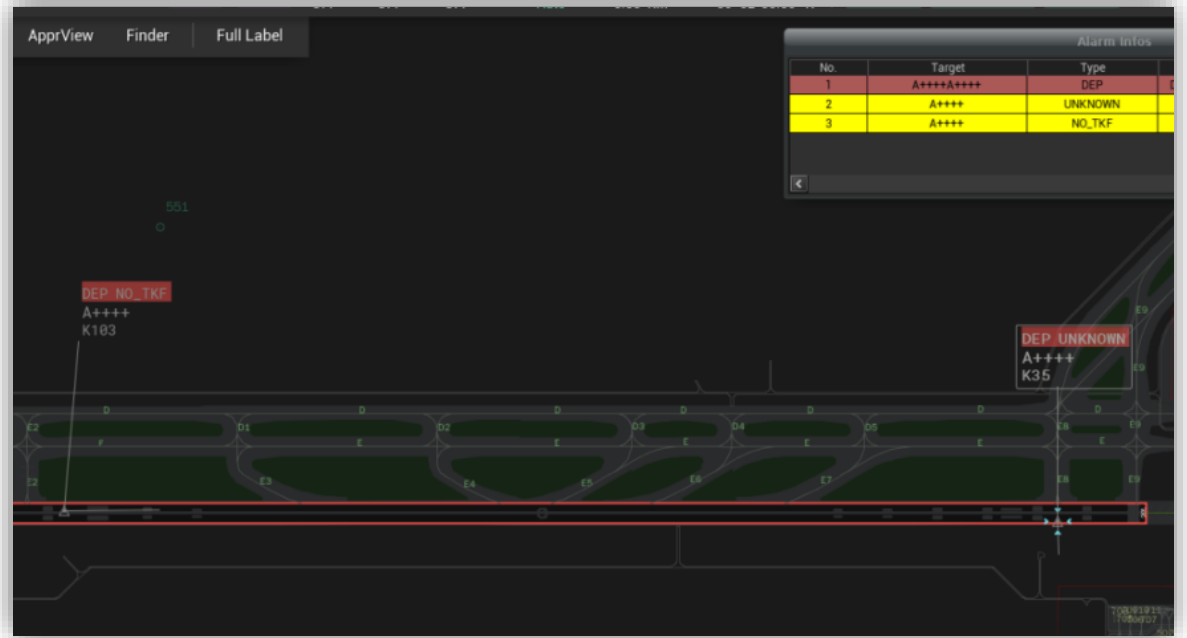




I. RIP Function Based on Surveillance Sensor



Unknown on runway



Departure conflict

Meets functional requirements of A-SMGCS Level II

II. RIP Function Based on Control Intention



Warning

AMG6300正在使用跑道！

OK

CTL	AMG9668	A1503	02L	LND
	ZYTX	A320/M	0321 104	

LIN	AMG6300	TKF	
	ZYHB	A320/M	666
	A1507		

02L - AMG6300 正在进入跑道 +5

TTX/TAX(0)

CTL -> LND

Warning

AMG9668正在使用跑道！

OK

LND	AMG9668	TOD	
	ZYTX	A320/M	MIS
	0321	A1503	104

跑道使用中

TTX/TAX(1)

TTX	AMG6300	A1507	02L	LIN
	ZYHB	A320/M	107 0321	37'22"

TTX -> LIN

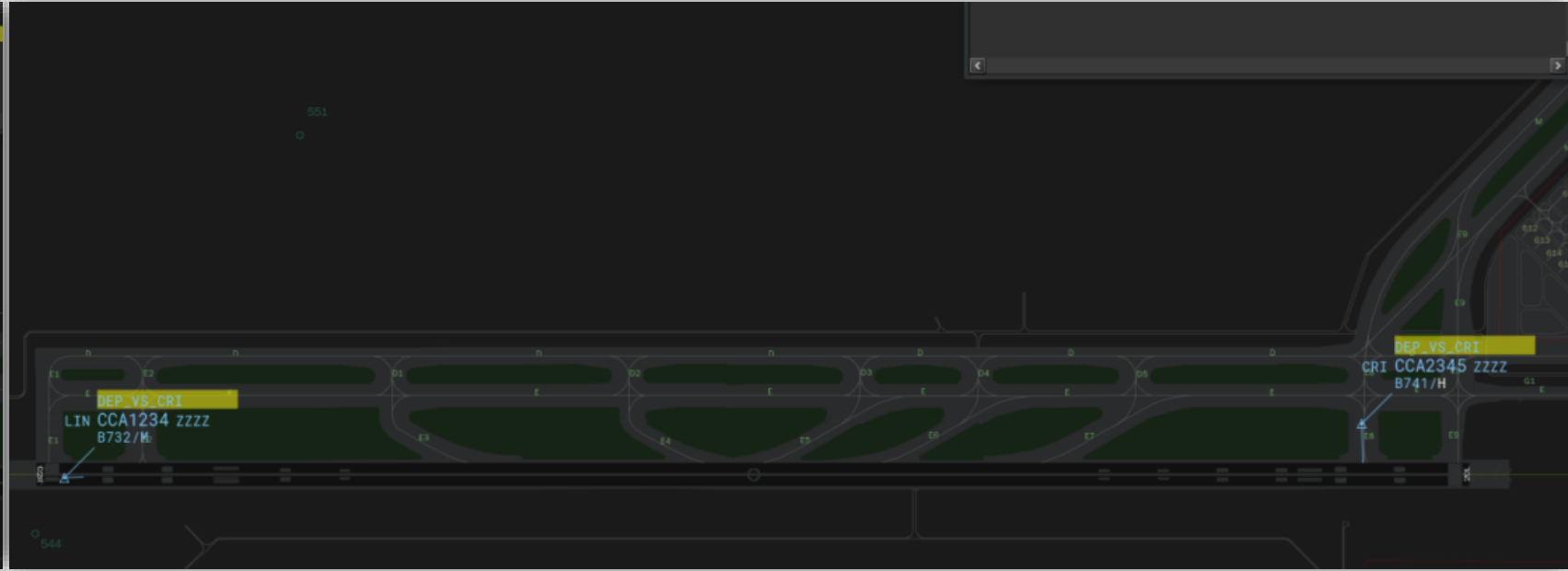
ensure all clearances are according to operational ATC procedures and rules



III. RIP Function Based on the Combination of Surveillance & Intention



No ENTER clearance warning



No Take-off Clearance warning

IV. RIP Function Based on Video



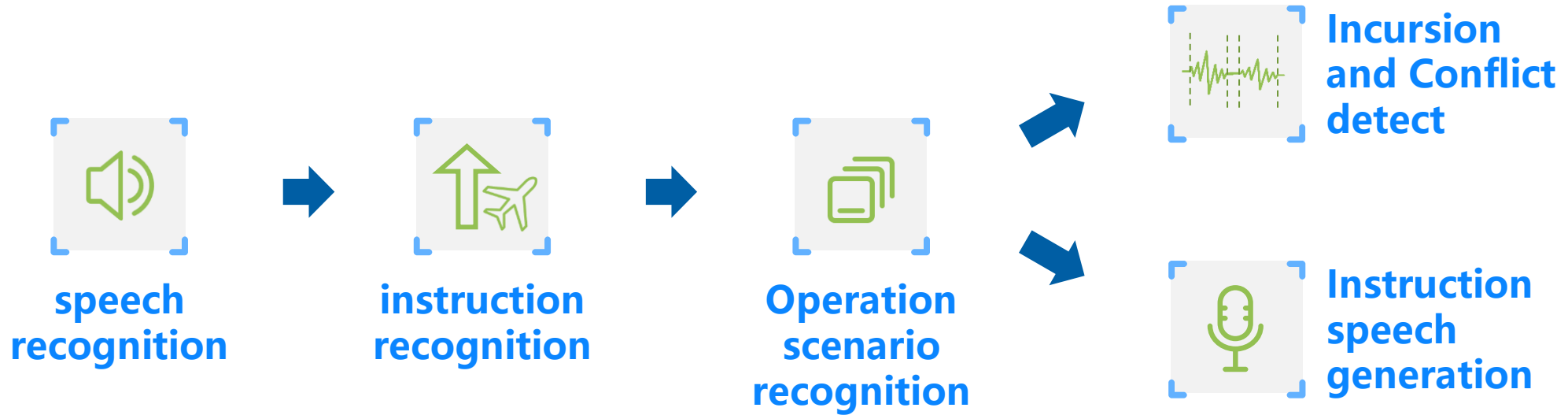
Arrival conflict

Departure conflict

Taxiway conflict



V. RIP Function Based on Voice Instruction



**Potential conflict
detection and warning**

- **Conflict detection between voice instruction and runway status**
- **Advanced warning of Voice based arrival/departure procedure instructions**
- **Voice normalization analysis of ATC instructions**

3



APPLICATION



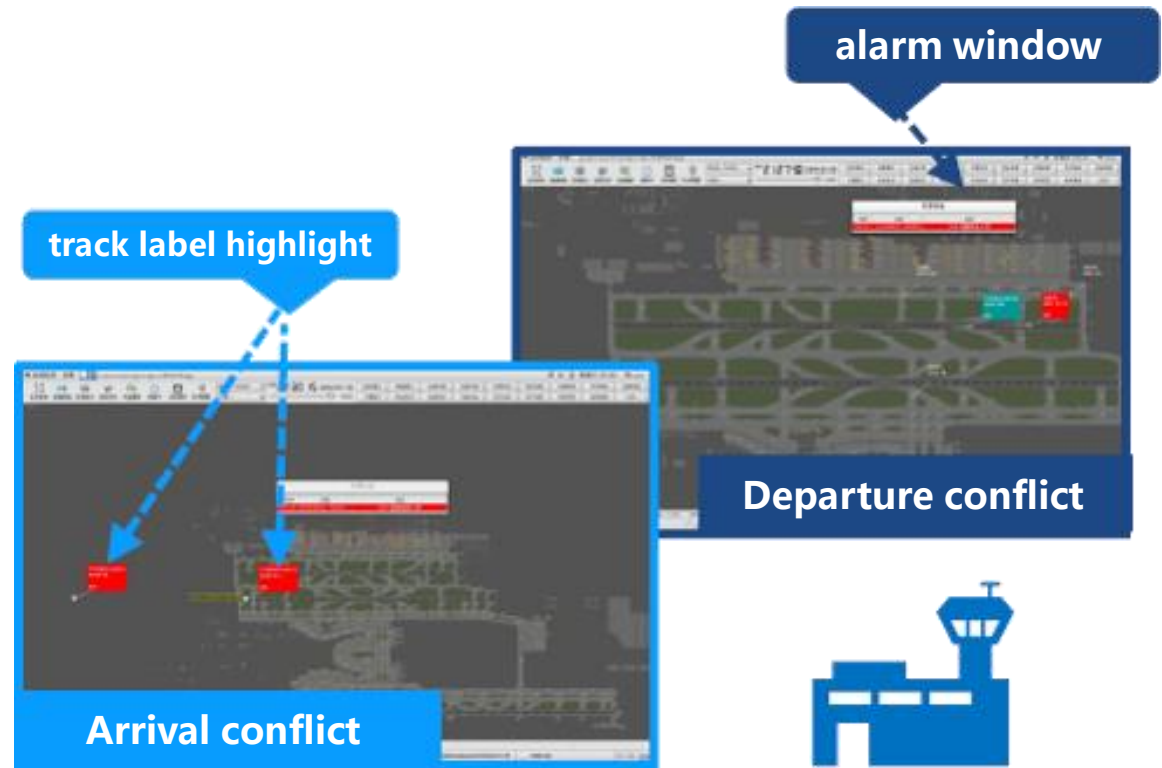
PART THREE

Effect of Integrated RIP Function



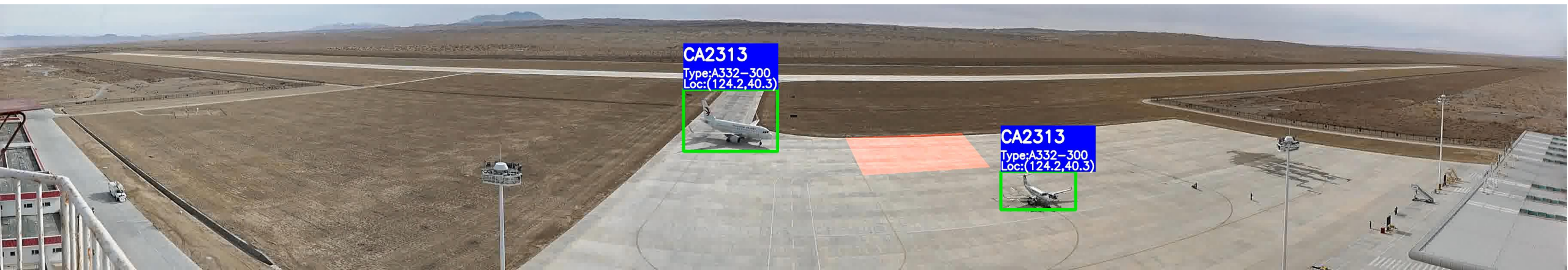
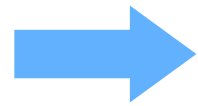
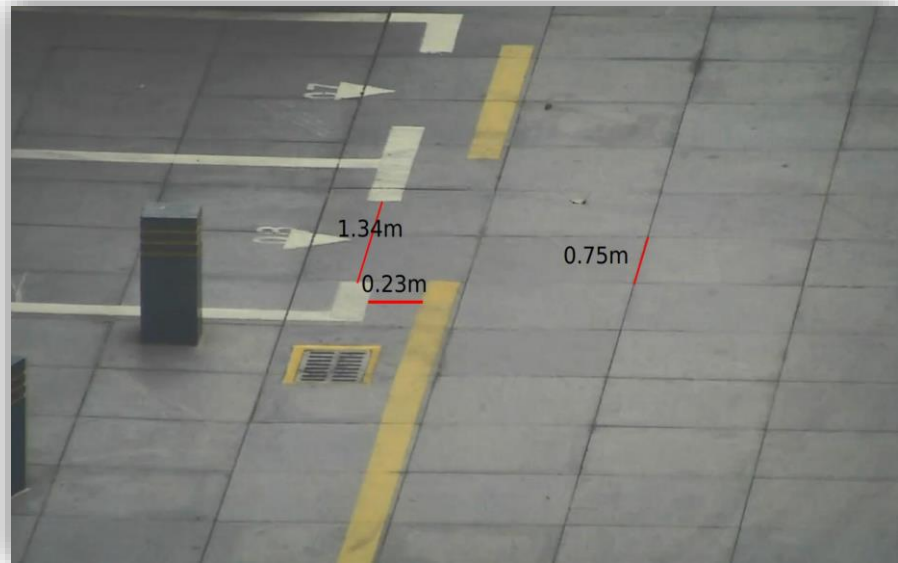
- pop up the real-time video of the alarm area automatically

- Alarm information linked in related window





Video/Voice processing in RIP





Tower ATM automation system can enhance the situational awareness of tower controllers and improve the control efficiency.



A full combination of A-SMGCS system and EFS system can be more beneficial.



Video processing effectively enhances the perception ability of tower.



The introduction of speech recognition expands the scope of safety detection.



it is recommended that integrating more RIP functions into the tower system to reduce the risk of runway operation.

**Thanks
for Listening**

