



Next**GEN**

RIPSA Analysis: SAT Data

Achieving the Future of NextGen Safety

Presented by: ANG-B32

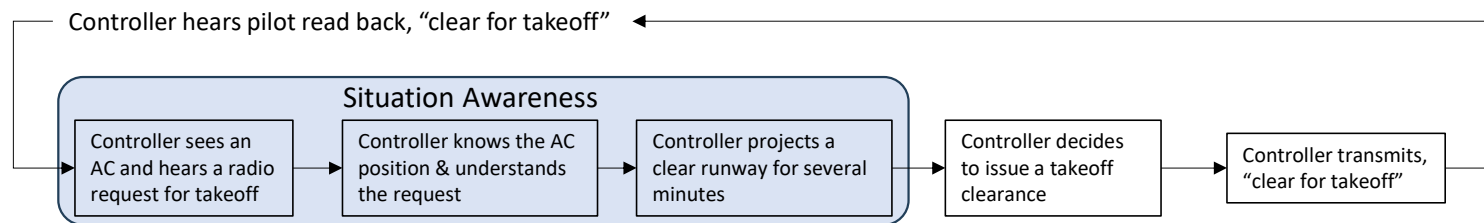
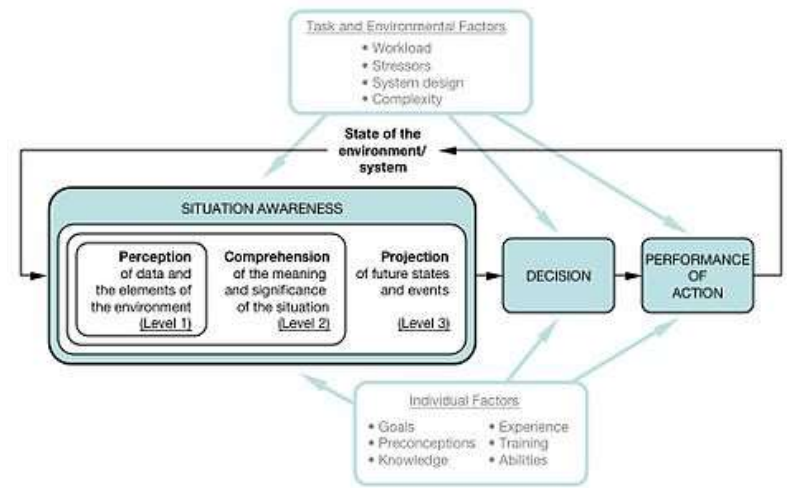
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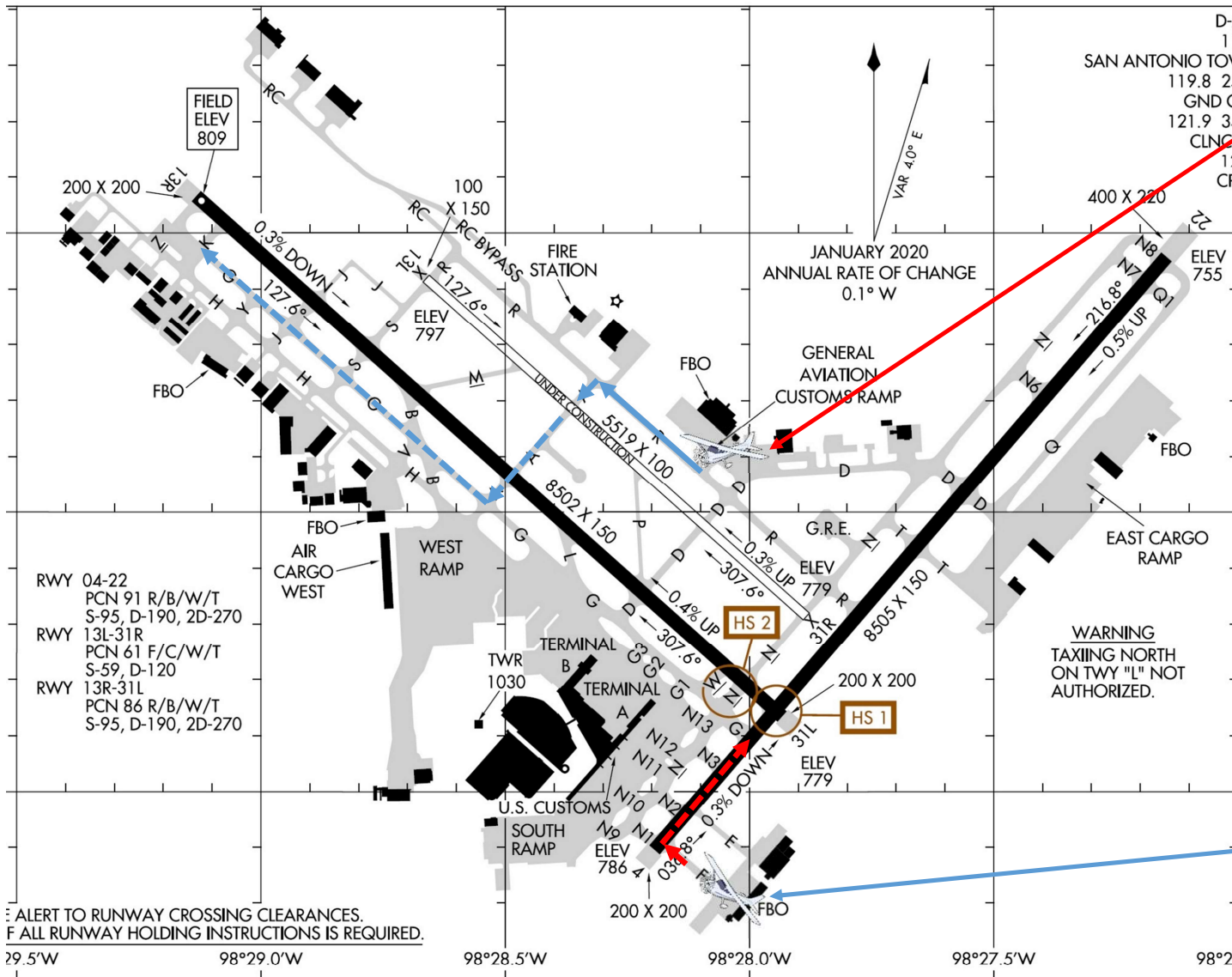


Situation Awareness

Formal Definition: "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future"

Informal Explanation: There is some situation in the world, and then there is the person's perception and comprehension of that situation, plus associated short-term projections. While a person's mental model matches the real-world situation, the person maintains situational awareness. Otherwise, situational awareness is degraded or lost. In either case, an operator's decisions are based on situational awareness.





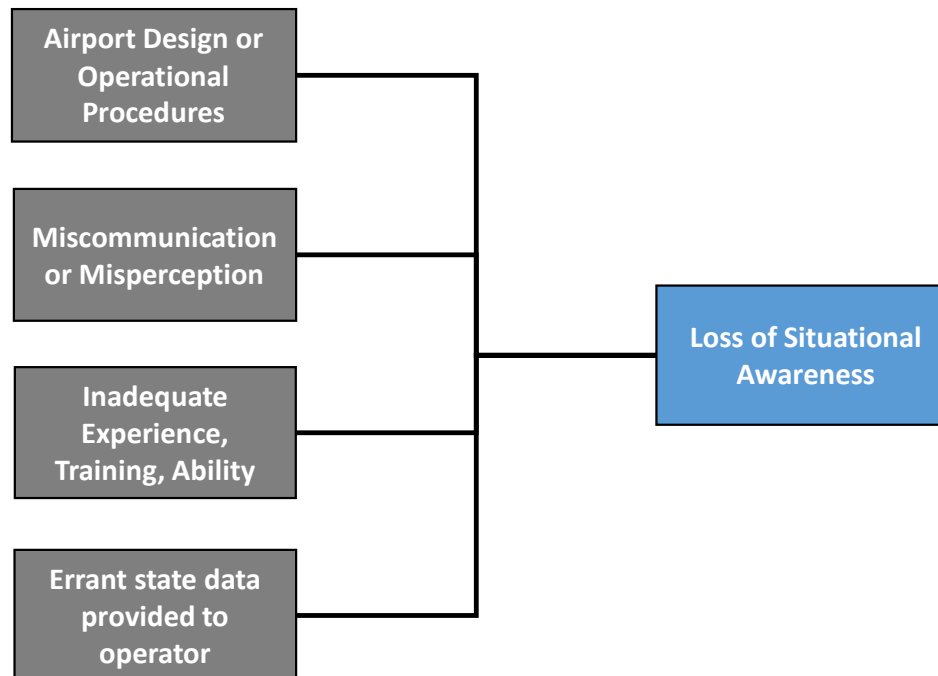
Controller thinks AC1 is here
 Controller issues taxi clearance from that spot

Example Loss of Situation Awareness

AIRCRAFT 1 CONTACTED GROUND CONTROL REQUESTING TO TAXI. GC DID NOT KNOW THE AIRCRAFT POSITION AND ISSUED INSTRUCTIONS FOR AIRCRAFT 1 TO TAXI VIA TAXIWAY R, TAXIWAY A AND HOLD SHORT OF RUNWAY 13L FOR A RUNWAY 13R AT TAXIWAY K DEPARTURE. THE PILOT READ BACK WAS CORRECT. AIRCRAFT 1 WAS PARKED AT THE FBO ON THE SOUTH SIDE OF THE AIRPORT AND TAXIED OUT ONTO RUNWAY 4 HEADING NORTHBOUND. GC ADVISED AIRCRAFT 1 THAT THEY WERE ON AN ACTIVE RUNWAY AND INSTRUCTED THEM TO TURN LEFT ON TAXIWAY GOLF

AC1 is actually here
 Pilot is not aware that R4 is active and taxis out looking for signs for taxiway R and A

Contributing Factors to Situational Awareness



Factors that routinely contributed to pilots/ground operators' loss of situational awareness as cited in KSAT Runway Incursion data from 2009-2022



Table 1. Number of Runway Incursions, 2009-18

Calendar Year	All Airports	SAT	Selected Airports																			
			MCO	IAD	PHX	MSP	IAH	SEA	CLT	LAS	FLL	ORD	DTW	LGA	LAX	EWR	JFK	BWI	SFO	BOS	SAN	DFW
2009	1085	12	3	9	7	9	4	7	8	10	7	11	11	3	10	8	6	4	9	11	1	16
2010	1216	14	2	3	8	4	6	18	11	7	7	14	5	2	16	4	7	4	11	12	0	17
2011	1314	15	5	7	4	7	10	6	17	7	12	22	4	1	20	5	7	4	13	11	1	6
2012	1397	6	1	5	9	12	3	5	9	6	13	24	9	9	27	12	4	10	12	10	2	13
2013	1580	11	4	3	9	12	2	7	16	19	6	24	16	4	26	7	7	10	6	14	5	4
2014	1630	9	5	7	26	3	6	12	23	10	5	18	9	13	33	19	18	9	13	12	3	21
2015	1870	9	3	11	16	12	14	11	23	28	7	47	18	13	27	6	14	4	19	21	2	22
2016	2324	13	5	4	4	32	15	17	11	17	4	38	28	9	33	7	5	8	26	15	3	29
2017	2416	27	2	5	6	29	5	21	33	15	11	22	39	11	30	14	9	9	22	32	3	20
2018	1792	15	3	7	12	14	13	17	19	24	5	25	12	9	26	9	4	9	27	25	4	11
'09-'18	16624	131	33	61	101	134	78	121	325	143	77	245	151	74	248	91	81	71	158	163	24	159

Source: ASIAs, RWS Database



Table 2. Number of runway incursions at San Antonio Int'l from 2009-18, by incident type.

YEAR	SAT	PD	OD	OE	VPD	OTH	OI
2009	12	11	0	0	1	0	0
2010	14	14	0	0	0	0	0
2011	15	9	1	1	4	0	0
2012	6	5	0	0	0	0	1
2013	11	8	0	0	1	0	2
2014	9	6	0	0	1	0	2
2015	9	7	0	0	1	0	1
2016	13	11	0	0	1	0	1
2017	27	16	0	0	5	1	5
2018	15	13	0	0	0	0	2
'09-'18	131	100	1	1	14	1	14
# ops per year (from HEAT/ATADS)	173593	173593	173593	173593	173593	173593	173593
# RI/# Ops per year	7.546E-04	5.761E-04	5.761E-06	5.761E-06	8.065E-05	5.761E-06	8.065E-05

PD	Pilot Deviation
OD	Operational Deviation
OE	Operational Error
VPD	Vehicle/pedestrian Deviation
OTH	Event does not meet OD/OE, PD, or VPD criteria
OI	Operational Incident



Collision tally for towered and non-towered airport, 2009-18

(NOTE: Used data for event sequence 490 (collision during takeoff/landing), 320 (runway incursions) and 200 (ground collision))

Event Sequence	Towered	Non-Towered
Takeoff/Landing (490)	0	14
Runway Incursion (320)	0	2
Ground Collision (200)	0	8
Grand Total	0	24



Distribution of runway incursions by category, 2009-18

SAT

RI Category	# of RI	% of Total
Cat A	0	0
Cat B	1	0.76
Cat C	47	35.88
Cat D + "N/A"	75 + 8	63.36
Sum	131	100 %

NAS - Towered

RI Category	# of RI	% of Total
Cat A	62	0.37
Cat B	62	0.37
Cat C	5588	33.62
Cat D + E + P + "N/A"	7563 +19 +4 +3326	65.64
Sum	16624	100 %

SOURCE: RI data comes from ASIAS RWS database



Runway Incursions due to Loss of Situational Awareness - SAT

- **112** out of 131 Runway Incursions* attributed to **Loss of Situational Awareness by Operators**
- On average, about 11.2 RIs per year
- Approximately 173k** operations per year (from ATADS)

RI Category	# of RI	Observed Occurrence Rate per 1M operations
Cat A	0	0
Cat B	1	0.576
Cat C	40	23.042
Cat D + "N/A"	71	40.900
Total	112	64.518

Rate of Runway Incursions due to Loss of Situational Awareness (Category C)

= 40 RIs ~~per 10 years~~/1.73M ops ~~per 10 years~~

= 23.042 RIs per million operations

*RI data comes from ASIAs RWS database for SAT over a 10-year period (2009-18)

**Operations data comes from ATADS (1.735929M over 10 years)



Likelihood Calculation

$$Likelihood = \left(\frac{0.0002}{\frac{0.008}{Exposure}} \right) * \left(\frac{0.125}{\frac{0.20}{Hazard Occurrences}} \right) * \left(\frac{Number\ of\ Events\ of\ Severity\ X}{Number\ of\ Events} \right)$$

Risk Framework



Note: This is an arbitrary example used to explain the mathematical calculation of likelihood.

SAT Runway Incursion Location Analysis



Questions and Discussion



Backup Slides



Baseline/Historical Analysis - risk of runway incursions at SAT* (using SAT RI data and SAT severity distribution)

Hazard: Loss of Situational Awareness (pilot/vehicle operator)

112 RIs over a 10-year period (2009-18)

On average, about 11.2 RIs per year (Runway Incursions at SAT associated with the hazard)

Over 173k** operations per year (from ATADS)

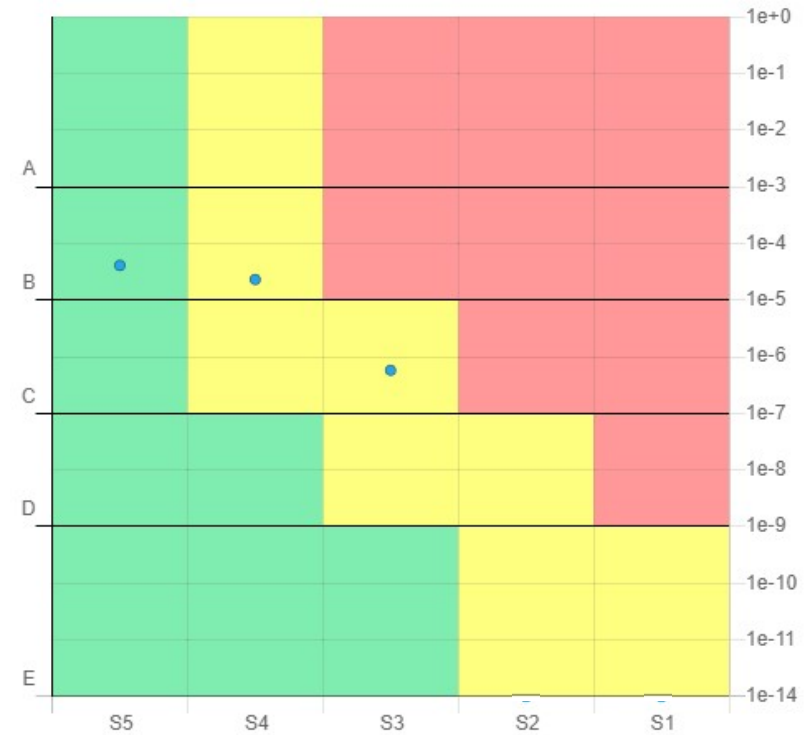
Severity Distribution – **based on ASIAs RI data for SAT**

Likelihood by Severity Category (using severity distribution from SAT)

Severity	Historical Risk
s1	Medium:1E (0)
s2	Medium:2E (0)
s3	Medium:3C (5.7422e-7)
s4	Medium:4B (2.3046e-5)
s5	Low:5B (4.0898e-5)

- Severity 1 → Collision***
- Severity 2 → CAT A RI
- Severity 3 → CAT B RI
- Severity 4 → CAT C RI
- Severity 5 → CAT D RI + "N/A"

Risk Matrix



Low to Medium Risk

*RI data comes from ASIAs RWS database for SAT

**Operations data comes from ATADS

***An effect categorized as catastrophic is one that results in at least one fatality or one fatal injury

Baseline/Historical Analysis - risk of runway incursions at SAT* (using SAT RI data and NAS-wide towered airports severity distribution)

Hazard: Loss of Situational Awareness (pilot/vehicle operator)

112 RIs over a 10-year period (2009-18)

On average, about 11.2 RIs per year (Runway Incursions at SAT associated with the hazard)

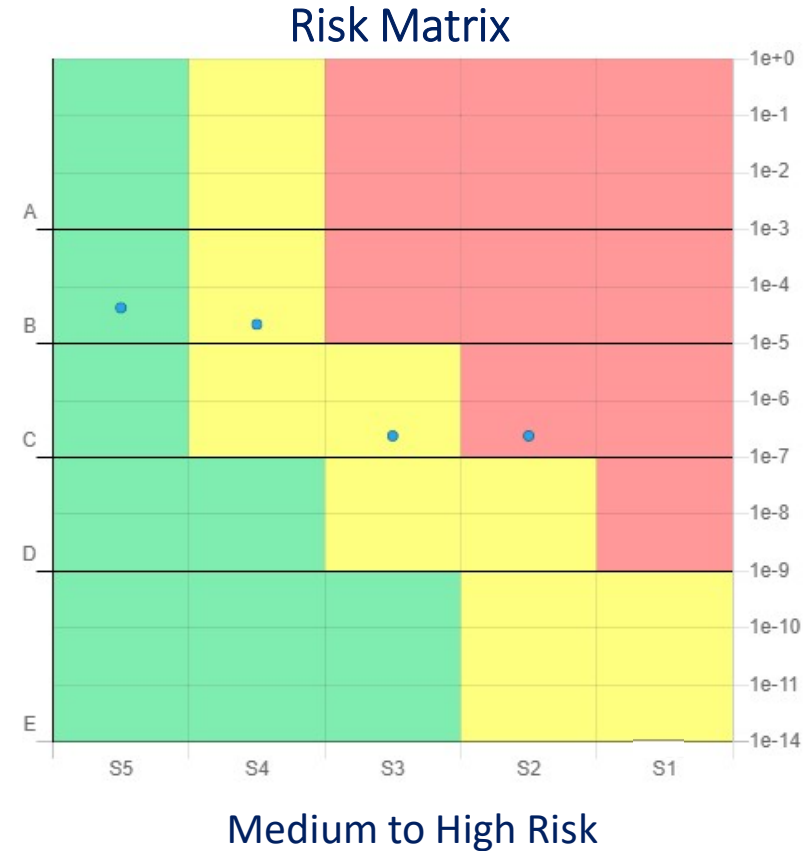
Over 173k** operations per year (from ATADS)

Severity Distribution – *based on ASIAs RI data for all NAS towered airports*

Likelihood by Severity Category
(using severity distribution from NAS towered airports)

Severity	Historical Risk
s1	Medium:1E (0)
s2	High:2C (2.3872e-7)
s3	Medium:3C (2.3872e-7)
s4	Medium:4B (2.1691e-5)
s5	Low:5B (4.235e-5)

- Severity 1 → Collision***
- Severity 2 → CAT A RI
- Severity 3 → CAT B RI
- Severity 4 → CAT C RI
- Severity 5 → CAT D RI + "N/A"



*RI data comes from ASIAs RWS database for SAT

**Operations data comes from ATADS

***An effect categorized as catastrophic is one that results in at least one fatality or one fatal injury

Severity distribution used for runway incursion analysis (2009-18 data)

SAT

RI Category	# of RI	% of Total	Equivalent Severity Category
		0	1
Cat A	0	0	2
Cat B	1	0.89	3
Cat C	40	35.72	4
Cat D + "N/A"	66 + 5	63.39	5
Sum	112	100 %	

NAS - Towered

RI Category	# of RI	% of Total	Equivalent Severity Category
		0	1
Cat A	62	0.37	2
Cat B	62	0.37	3
Cat C	5588	33.62	4
Cat D + E + P + "N/A"	7563 +19 +4 +3326	65.64	5
Sum	16624	100 %	

