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- 2.THE ATC PROFESSION- THE DEMAND
- 3.HUMAN FACTORS CONTRIBUTING TO ATC ERRORS
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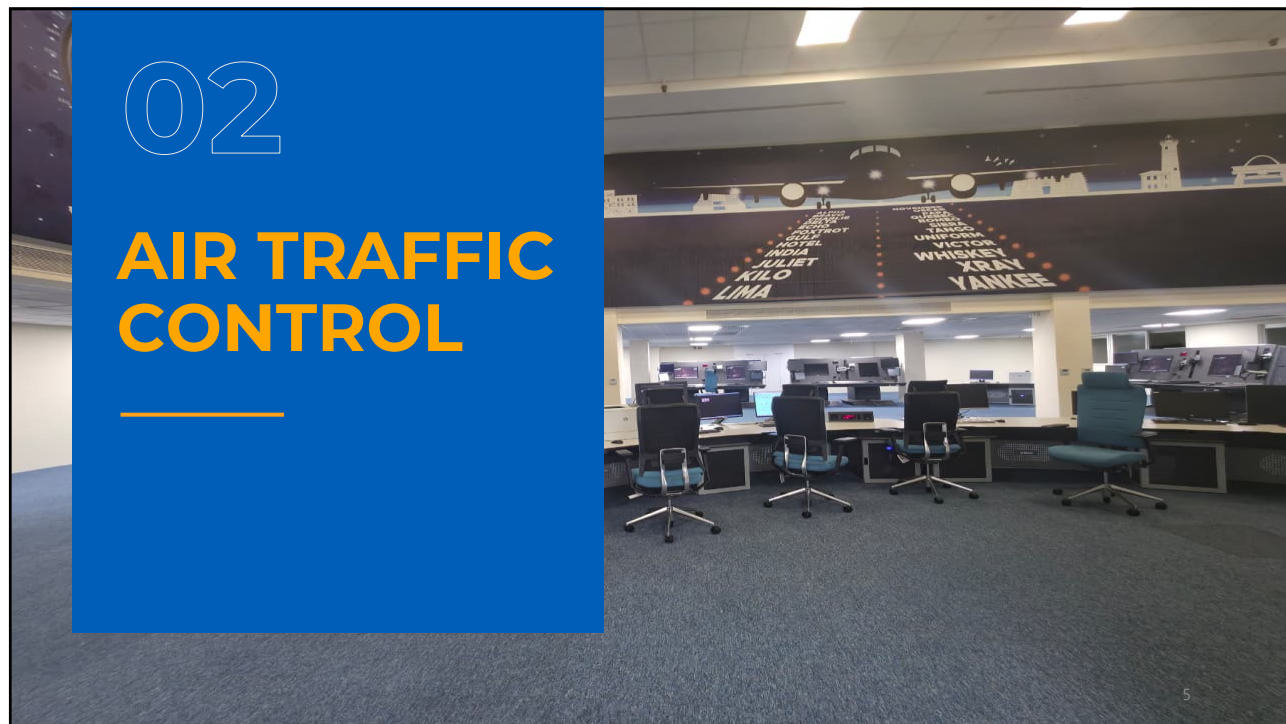
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HUMAN FACTORS

The study of how people interact with the systems, environment, technology, procedures and other people around them—and how those interactions affect safety and performance.



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AIR TRAFFIC CONTROL

ATC demands continuous, high-level concentration:

- ✓ Monitor multiple aircraft simultaneously.
- ✓ Process visual, auditory and procedural information in parallel.
- ✓ Maintain separation at all times.
- ✓ Communicate with pilots, adjacent sectors and other agencies in real time.
- ✓ Respond immediately to changing conditions.

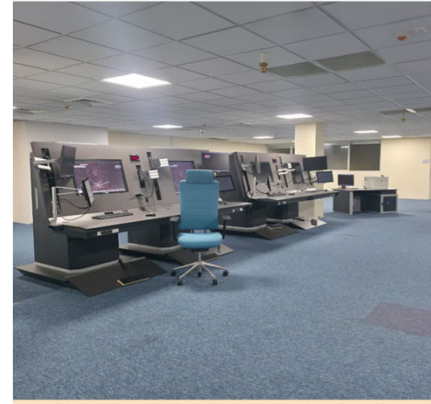
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AIR TRAFFIC CONTROL

- ❑ The operational complexity intensifies at airports handling mixed traffic, where long runways, frequent crossings, towing operations, and high movement volumes demand heightened coordination.
- ❑ In such dynamic environments, controllers must process hundreds of variables simultaneously, with every second carrying critical importance.

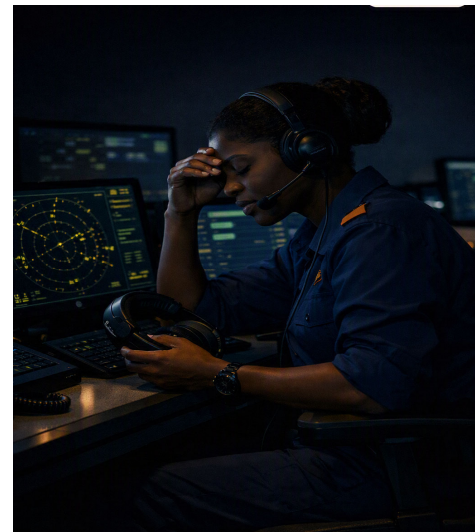


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COGNITIVE LOAD AND SAFETY

- ❑ Air traffic controllers experience what scientists call high cognitive load.
- ❑ They must constantly:
 - scan for potential conflicts,
 - maintain mental models of multiple flight paths,
 - make rapid decisions based on dynamic information and
 - communicate precisely and calmly with multiple parties.



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COGNITIVE LOAD AND SAFETY

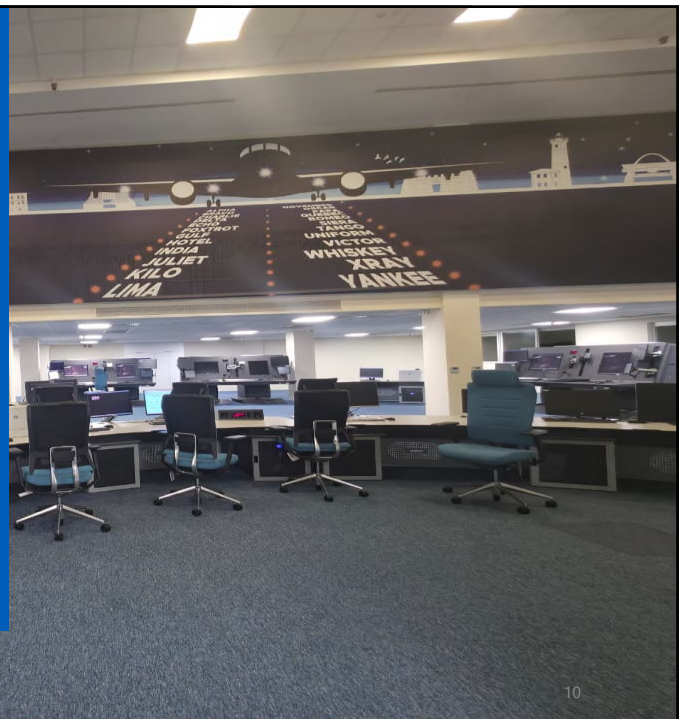
- ❑ High workload, especially during peak traffic or abnormal situations, increases the likelihood of errors.
- ❑ Low workload, conversely, can unmask physiological sleepiness, making it harder to stay alert during quiet periods.



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HUMAN FACTORS CONTRIBUTING TO ATC ERRORS



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HUMAN FACTORS

Situational Awareness



Real-time awareness of aircraft, weather, and airspace is vital for safety. Distractions or overload can erode situational awareness, leading to poor decisions.

Training and Education



Limited training or experience in complex traffic can impair performance. Simulations help, but they rarely match real-world dynamics.



HUMAN FACTORS

Communication Breakdowns



Misunderstandings between ATCOs and pilots, or among ATCOs themselves, can lead to incorrect instructions or missed warnings. Language barriers, radio interference, and the use of non-standard phraseology compound this risk.





HUMAN FACTORS

Fatigue



ATCOs often work long shifts(nights), or in rotating schedules. Fatigue impairs reaction times, decision-making, and situational awareness, increasing the risk of errors.

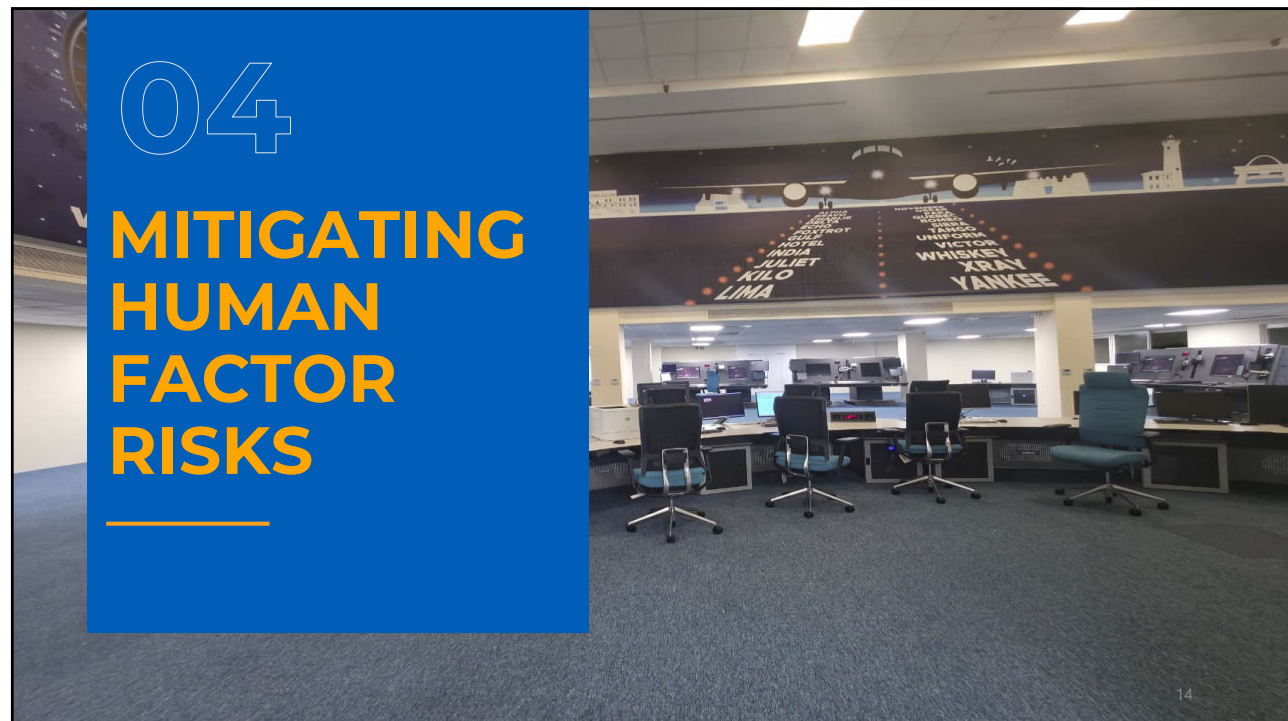
Workload and Stress



Controllers face intense pressure, and when workload spikes—especially during failures—the risk of errors rises sharply.



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MITIGATING HUMAN FACTOR RISKS

1. Ergonomic System Design:

Modern ATC systems account for human limits with intuitive interfaces, automated alerts, and decision-support tools to ease cognitive load.



2. Fatigue Management:

Duty-Time Rules = Managed Fatigue

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MITIGATING HUMAN FACTOR RISKS

3. Standardized Communication Protocols:

Standardized phraseology ensures clarity across languages and cultures.

A = Alpha	H = Hotel	O = Oscar	V = Victor
B = Bravo	I = India	P = Papa	W = Whiskey
C = Charlie	J = Juliet	Q = Quebec	X = X-Ray
D = Delta	K = Kilo	R = Romeo	Y = Yankee
E = Echo	L = Lima	S = Sierra	Z = Zulu
F = Foxtrot	M = Mike	T = Tango	
G = Golf	N = November	U = Uniform	

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MITIGATING HUMAN FACTOR RISKS

4. Continuous Training:

Ongoing training with high-pressure and emergency simulations prepares controllers for real challenges, with human factors awareness built in.

5. Team Resource Management (TRM):

TRM strengthens ATC communication, teamwork, and decision-making.



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CONCLUSION

**People create safety.
Technology enables it.
Only by addressing human factors
can we guarantee safe skies.**

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