

# Airspace Incident Investigation



**Civil Aviation Authority of New Zealand**

**Richard White**

**Manager Safety Investigation**





## **A New Zealand airspace incidents 1994-2002: A causal trend analysis**

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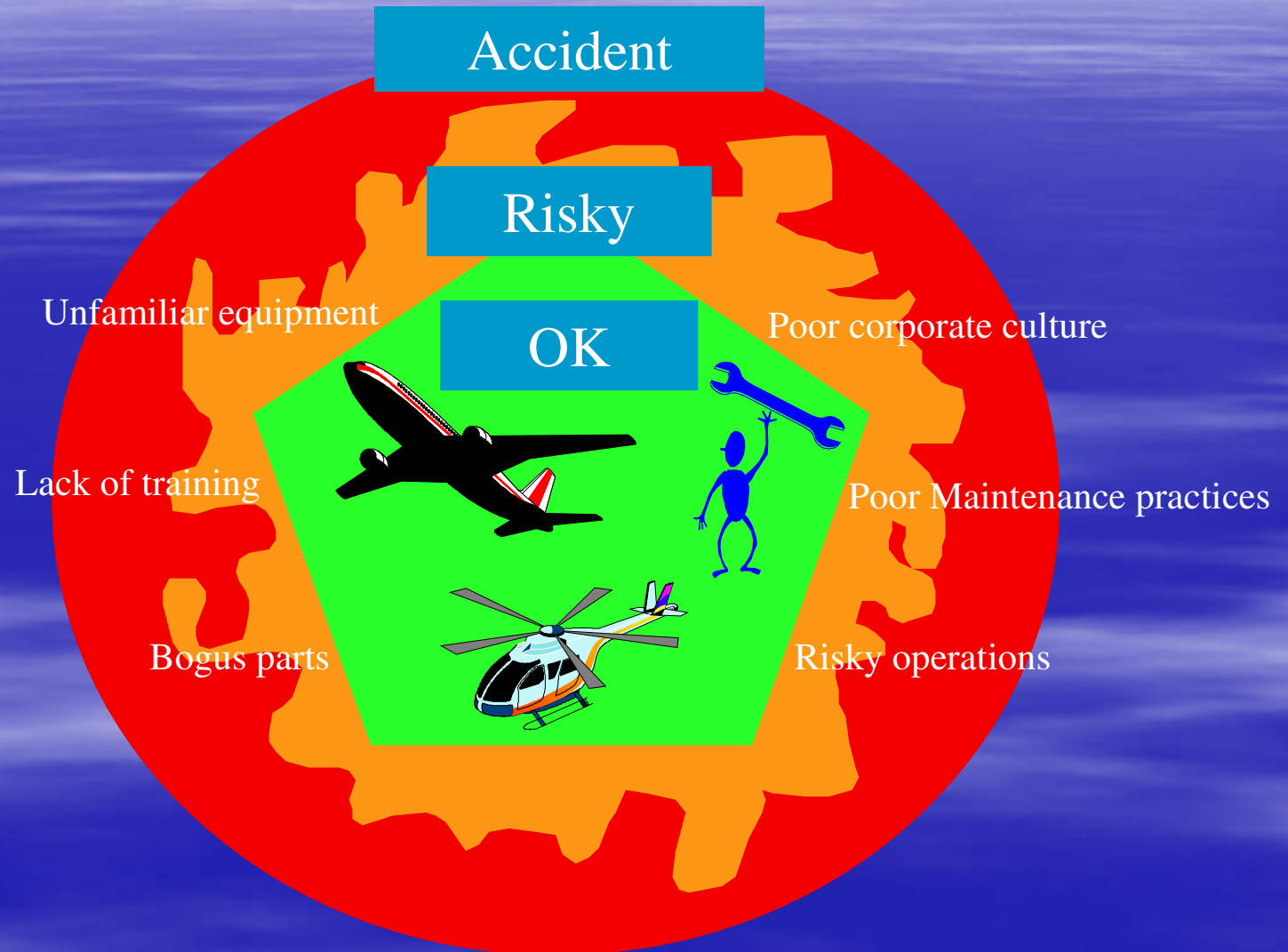


# CIVIL AVIATION AUTHORITY

## POLYGON OF CERTAINTY



# CIVIL AVIATION AUTHORITY POLYGON OF UNCERTAINTY





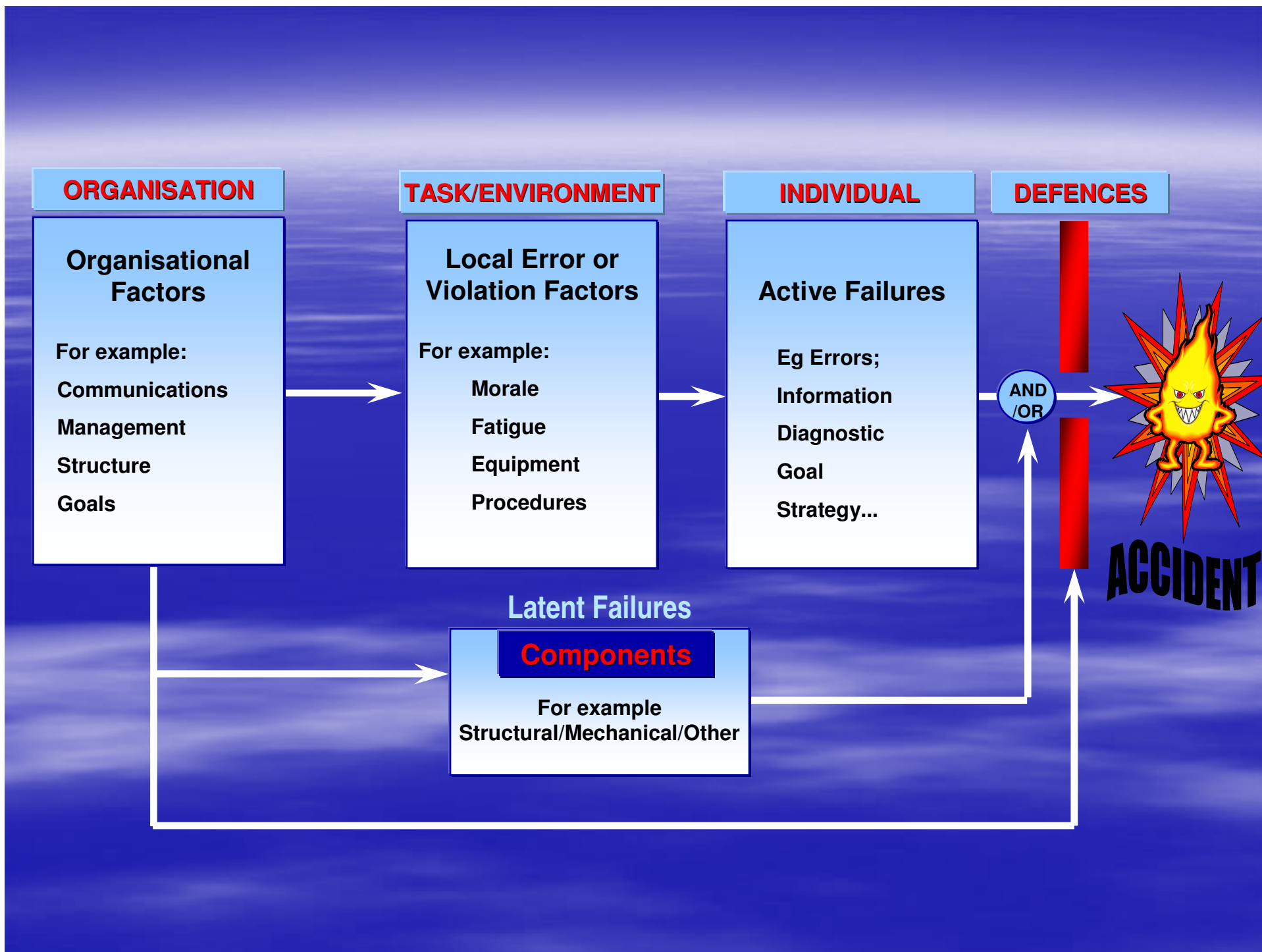
# Just Culture

- **Purposeful Behaviour :-** Behaviour carried out with the intent of causing an incident or injury, or to mislead the investigation.
- **Behaviour with knowledge of outcome :-** Behaviour where something has occurred (eg. an error) that the person is aware of, and which the person knows will (likely) lead to an incident, or mislead the investigation.
- **Behaviour under influence of drugs or alcohol :-** Any behaviour that leads to an incident where the behaviour follows the intentional consumption of alcohol or other drugs.
- **Reckless Behaviour :-** Behaviour carried out with conscious disregard that the behaviour will significantly and unjustifiably increase the probability of an incident occurring.
- **Negligent Behaviour :-** Situation where the person should have known that his/her behaviour would significantly and unjustifiably increase the probability of an incident occurring.
- **Multiple acts of Negligent Behaviour :-** Do the multiple acts indicate a general lack of care and professionalism?

# SAFETY CONTROL PROCESS: INDIVIDUAL OCCURRENCES



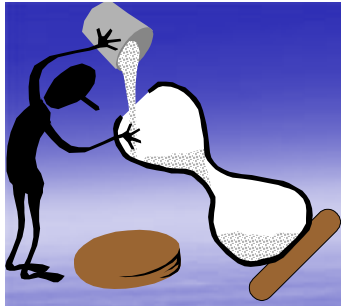




# ORGANISATION FAILURE ITEMS

- ☾ Inappropriate Goals or Policies
- ☾ Organisation Structural Deficiencies
- ☾ Inadequate Communications
- ☾ Poor Planning
- ☾ Inadequate Control and Monitoring
- ☾ Design System Deficiencies
- ☾ Inadequate Defences
- ☾ Unsuitable Materials
- ☾ Unsuitable Equipment
- ☾ Poor Procedures
- ☾ Poor Training
- ☾ Poor Coordination
- ☾ Inadequate Regulation
- ☾ Other Organisation Factor





# ERROR ITEMS



- ✧ Task Unfamiliarity
- ✧ Time Shortage
- ✧ Poor Signal: Noise
- ✧ Poor Human-System Interface
- ✧ Designer User Mismatch
- ✧ error Irreversibility
- ✧ Information Overload
- ✧ Negative Task Transfer (Habits)
- ✧ Task Overload
- ✧ Risk Misperception
- ✧ Poor System Feedback
- ✧ Inexperience (Not Lack of Training)
- ✧ Lack of Knowledge
- ✧ Task/Education Mismatch
- ✧ Poor Instructions/Procedures
- ✧ Inadequate Checking
- ✧ Hostile Environment
- ✧ Other Environmental Factor (e.g. Weather)
- ✧ Interpretation difficulties
- ✧ Disturbed Sleep Patterns
- ✧ Fatigue - Other
- ✧ Drugs/Alcohol
- ✧ Visual Illusion
- ✧ Disorientation/Vertigo
- ✧ Physiological Other
- ✧ Monotony/Boredom
- ✧ Lack of Confidence
- ✧ Poor Attention Span
- ✧ Psychological Other
- ✧ Other Error Enforcing Condition

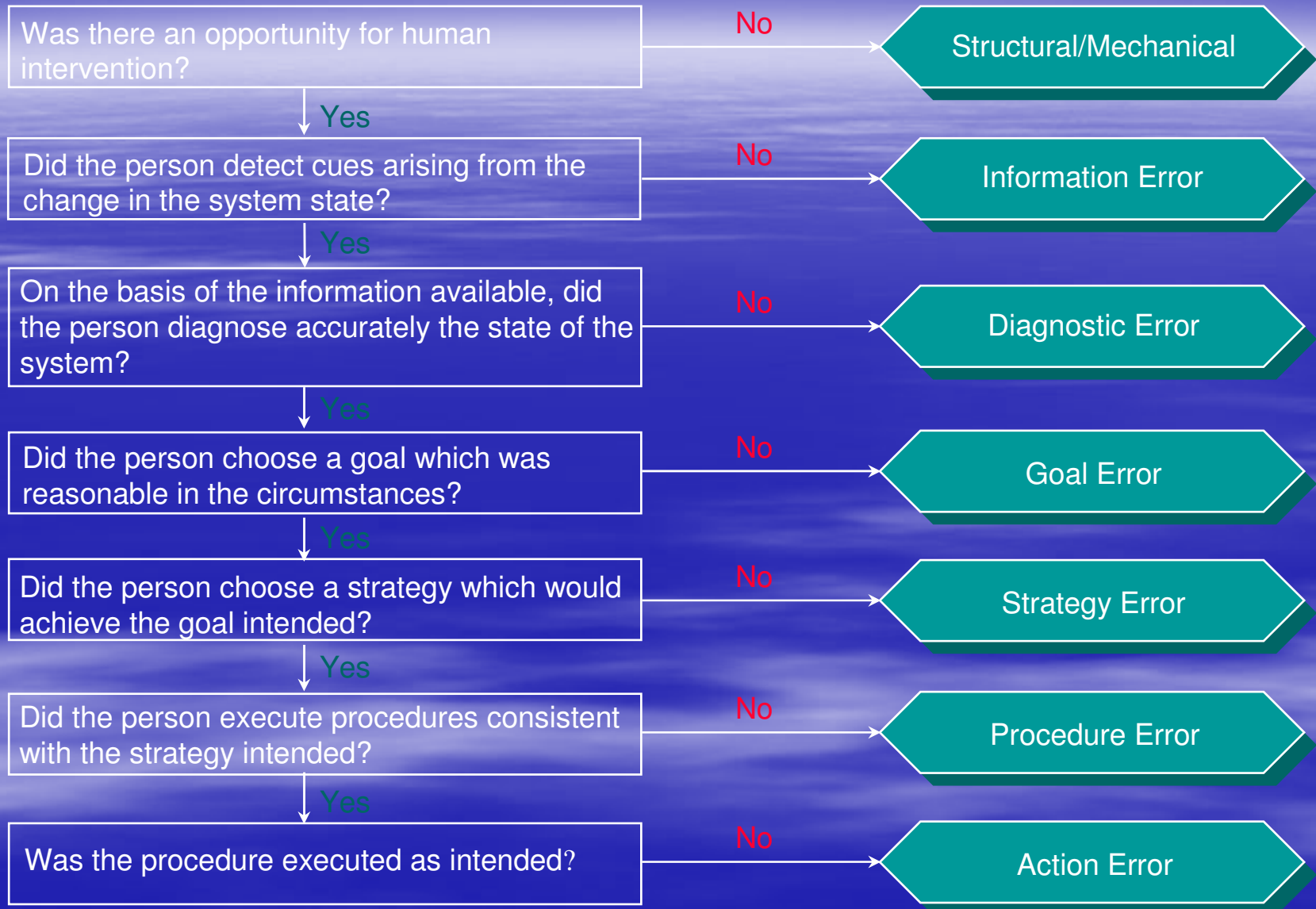


# VIOLATION ITEMS



- ☾ Lack of Safety Culture
- ☾ Management/Staff Conflict
- ☾ Poor Morale
- ☾ Poor Supervision & Checking
- ☾ Group Violation Condoning Attitude
- ☾ Hazard Misperception
- ☾ Lack of Management Care/Concern
- ☾ Lack of Pride in Work
- ☾ Risk Taking Culture Encouraged
- ☾ Complacency (i.e.. It Can't Happen)
- ☾ Learned Helplessness (i.e... Who Cares)
- ☾ Perceived License to Bend Rules
- ☾ Age/Sex Factor
- ☾ Other Violation Enforcing Condition

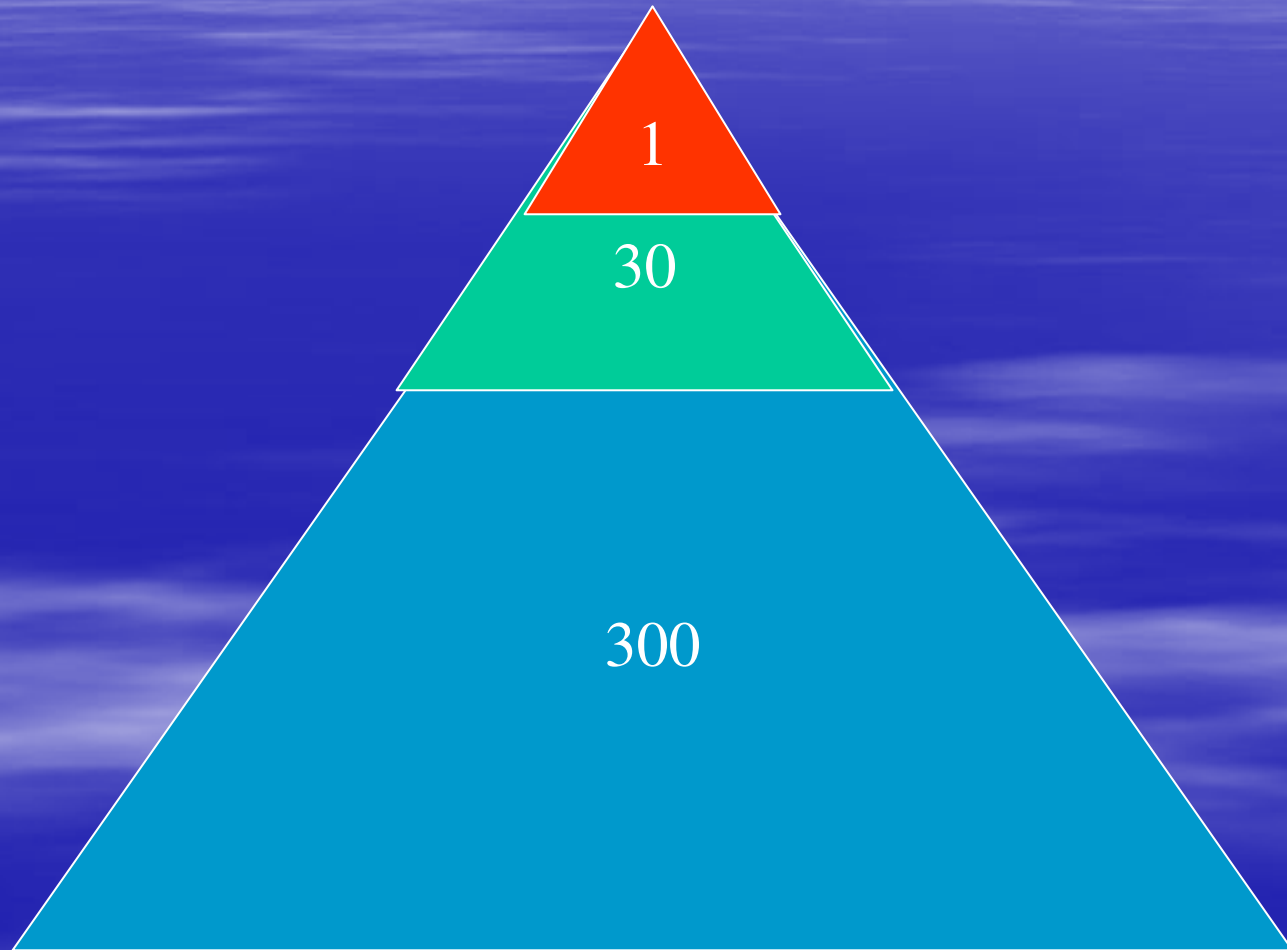
# Active Failure Classification



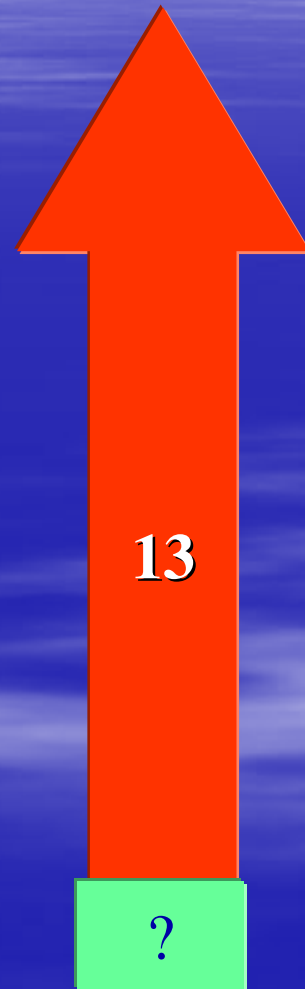
The values shown in the green boxes are the codes loaded into the AQS system for active failures.



# Effective incident reporting programme



# Ineffective incident reporting



What we are seeing

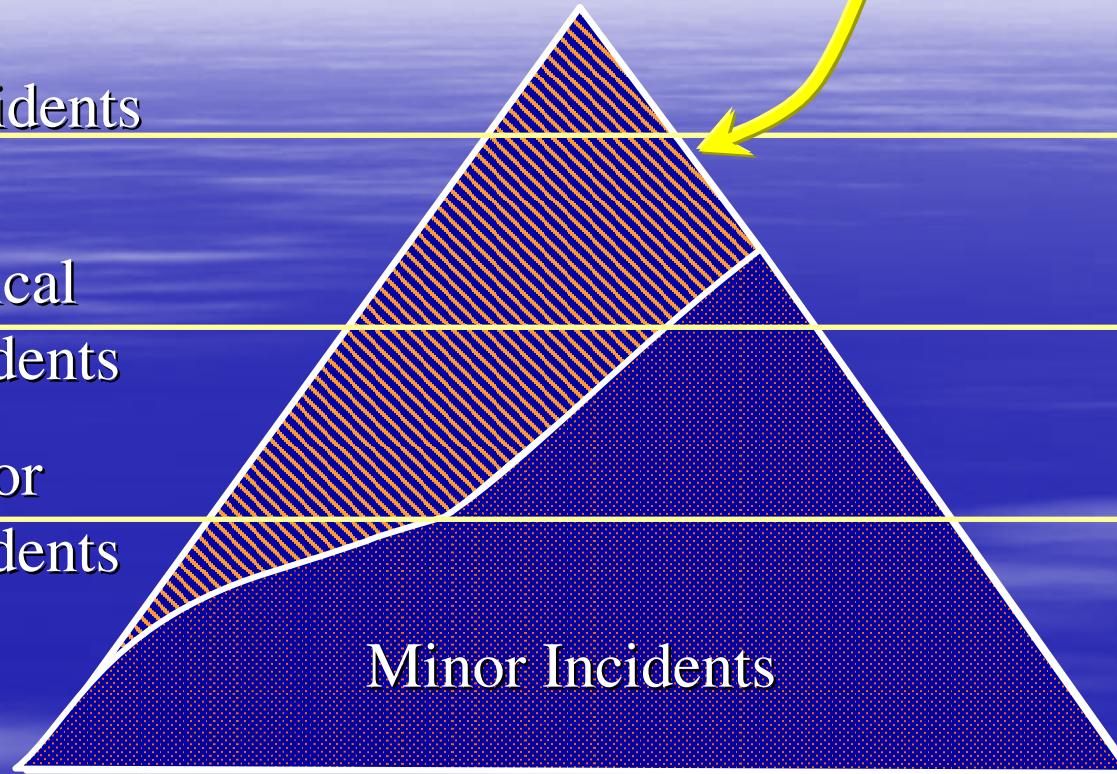
Accidents

Critical  
Incidents

Major  
Incidents

Minor Incidents

What we think exists but is not being  
reported



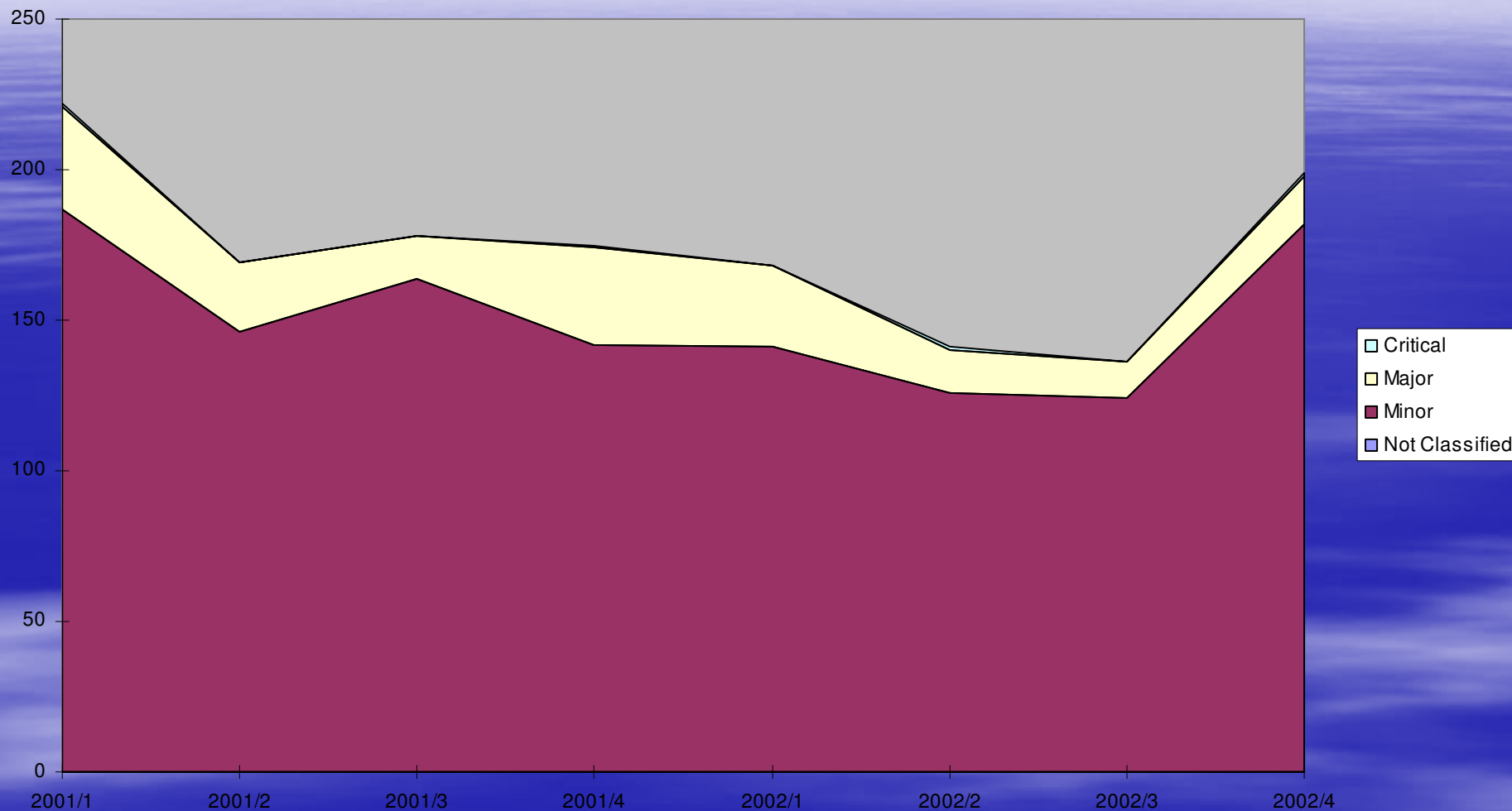


AIRSPACE INCIDENT	Number	Percentage
REDUCED VERTICAL SEPARATION MINIMA	1	0.01
REDUCED NAVIGATION PERFORMANCE	3	0.04
SHORT TERM CONFLICT ALERT	5	0.07
CONTROLLER/PILOT DATALINK COMMUNICATIONS	7	0.10
PILOT READBACK DEFICIENCY	42	0.58
ATS FLIGHT INFORMATION DEFICIENCY	115	1.59
TRAFFIC COLLISION AVOIDANCE SYSTEM	157	2.17
NEAR COLLISION	158	2.19
FLIGHT ASSIST	227	3.14
PILOT POSITION REPORTING DEFICIENCY	240	3.32
PILOT FLIGHT PLANNING DEFICIENCY	240	3.32
UNAUTHORISED ALTITUDE PENETRATION	381	5.28
ATS FLIGHT PLANNING SYSTEM DEFICIENCY	423	5.86
ATS CLEARANCE/INSTRUCTION DEFICIENCY	600	8.31
BREACH OF OTHER CLEARANCE	718	9.94
OTHER	812	11.25
ATS COORDINATION DEFICIENCY	823	11.40
LOSS OF SEPARATION	872	12.08
UNAUTHORISED AIRSPACE INCURSION	1396	19.34

**Number of airspace incidents in NZ airspace 1994-  
2002 according to category**



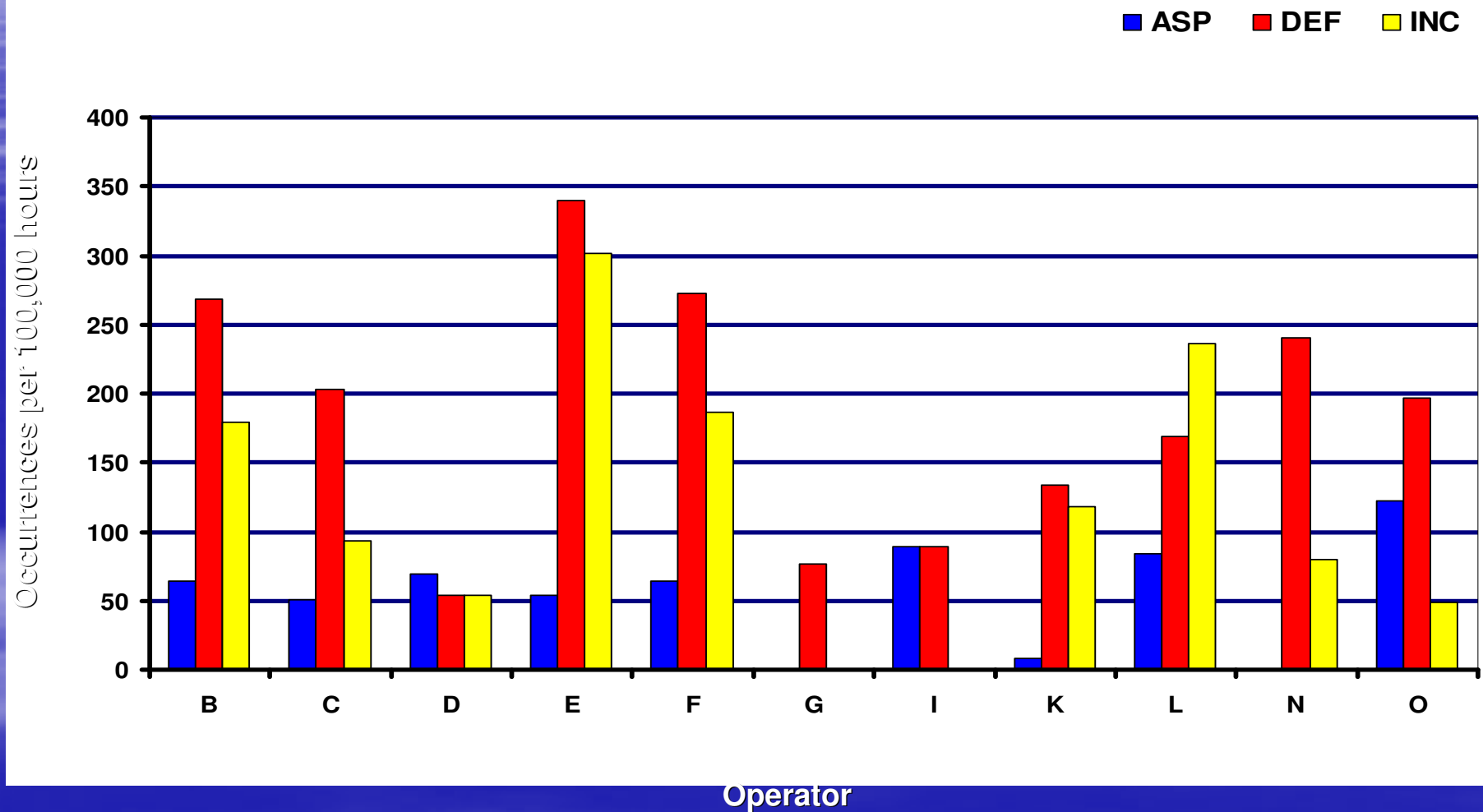
# AIRSPACE CRITICALITY TREND



## *Six-Monthly Comparison*

•Aircraft Group	•Severity	•1 Jan to 30 Jun 2001	•1 Jan to 30 Jun 2002	•Change
•13,608 kg and above	•Critical	•0	•0	•0
	•Major	•14	•1	•- 13
	•Minor	•26	•32	•+ 6
•5,670 to 13,608 kg	•Critical	•0	•0	•0
	•Major	•9	•12	•+ 3
	•Minor	•24	•13	•- 11
•Below 5,670 kg, Helicopters and Sport	•Critical	•0	•1	•+ 1
	•Major	•18	•17	•- 1
	•Minor	•130	•118	•- 12
•Unknown	•Critical	•1	•0	•- 1
	•Major	•16	•10	•- 6
	•Minor	•153	•105	•- 48
•Total	•Critical	•1	•1	•0
	•Major	•57	•40	•- 17
	•Minor	•333	•268	•- 65

## Occurrence Rate Comparison by Operator



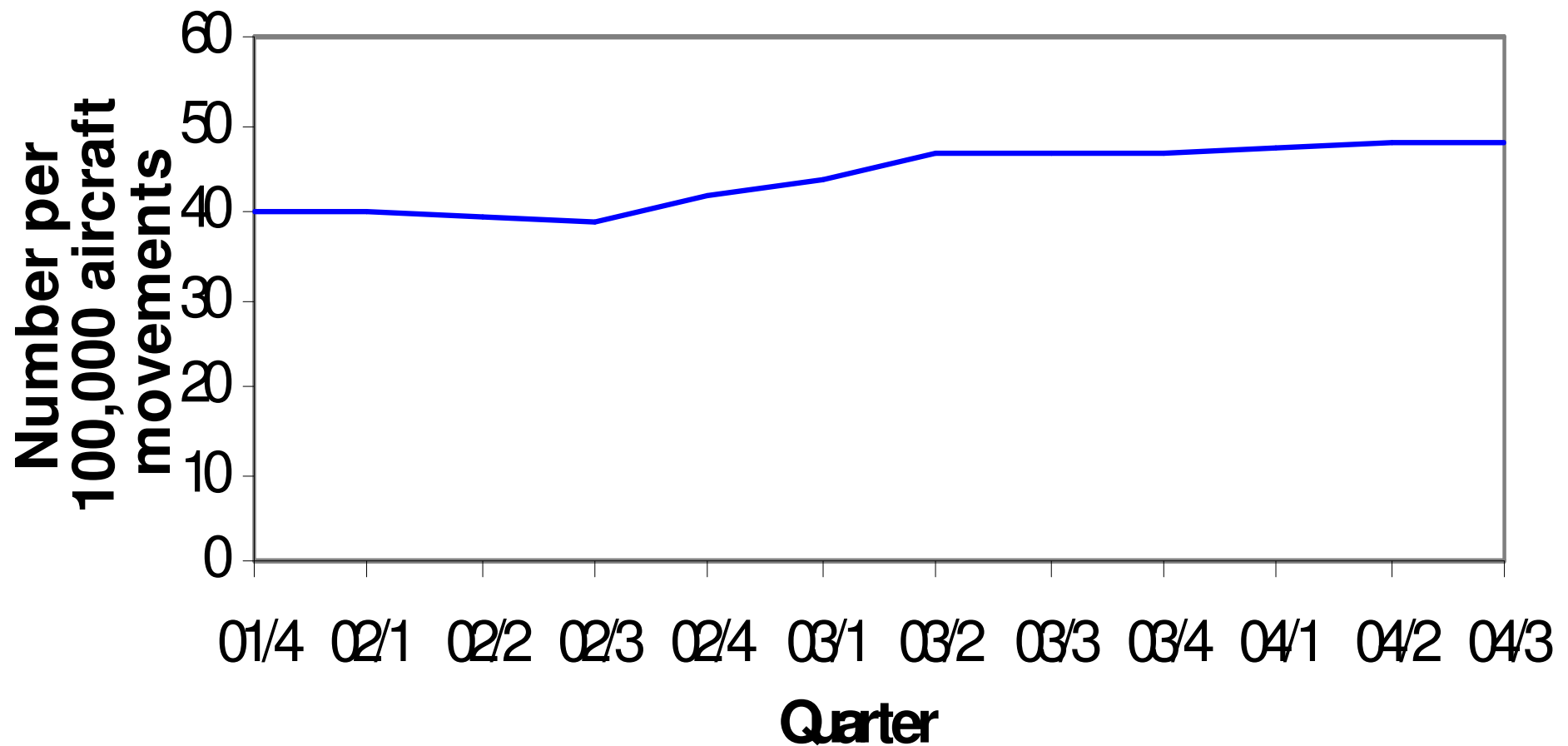
DESCRIPTOR	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Near Collision	15	28	12	17	8	11	11	9	11	12
Unauthorised Altitude Penetration	53	47	30	37	42	27	39	48	39	42
Unauthorised Airspace Incursion	151	105	83	129	167	128	159	144	189	212
Pilot Readback Deficiency	1	9	5	2	6	7	6	1	3	6
Pilot Position Reporting Deficiency	16	30	12	15	32	20	14	16	53	52
Pilot Flight Planning Deficiency	9	13	29	41	34	13	20	12	39	51
Other Causes	76	100	113	72	44	36	39	71	45	44
Loss Of Separation	77	75	79	107	111	53	99	88	70	55
ATS Flight Planning System Deficiency	73	61	30	42	29	30	21	26	14	49
ATS Flight Information Deficiency	4	10	11	11	8	11	20	11	7	14
ATS Co-ordination Deficiency	102	88	90	72	45	46	83	63	61	110
ATS Clearance/Instruction Deficiency	70	64	37	54	44	40	33	62	51	78
Flight Assist	23	29	30	34	31	14	9	11	7	18
Breach Of Other Clearance	20	180	57	93	66	72	56	73	62	107
Traffic Collision Avoidance System					3	28	35	29	37	42
Short Term Conflict Alert						2	1			6
Reduced Navigation Performance						1		1		2
Controller/Pilot Datalink						1	2	1		1
Reduced Vertical Separation Minima								1		1
<b>TOTAL AIRSPACE INCIDENTS</b>	690	839	618	726	670	540	647	667	661	902

**•Six-Monthly Comparison**  
*Number of Airspace Incidents*

Aircraft Group	1 Jul to 31 Dec	1 Jul to 31 Dec	Change	
	2002	2003	Number	Percentage
13,608 kg and above	42	29	- 13	- 31.0
5,670 to 13,608 kg	23	19	- 4	- 17.4
2,721 to 5,670 kg	10	8	- 2	- 20.0
Below 2,721 kg	89	103	+ 14	+ 15.7
Helicopters	17	29	+ 12	+ 70.6
Sport	9	10	+ 1	+ 11.1
Unknown	149	174	+ 25	+ 16.8
<b>Total</b>	<b>339</b>	<b>372</b>	<b>+ 33</b>	<b>+ 9.7</b>

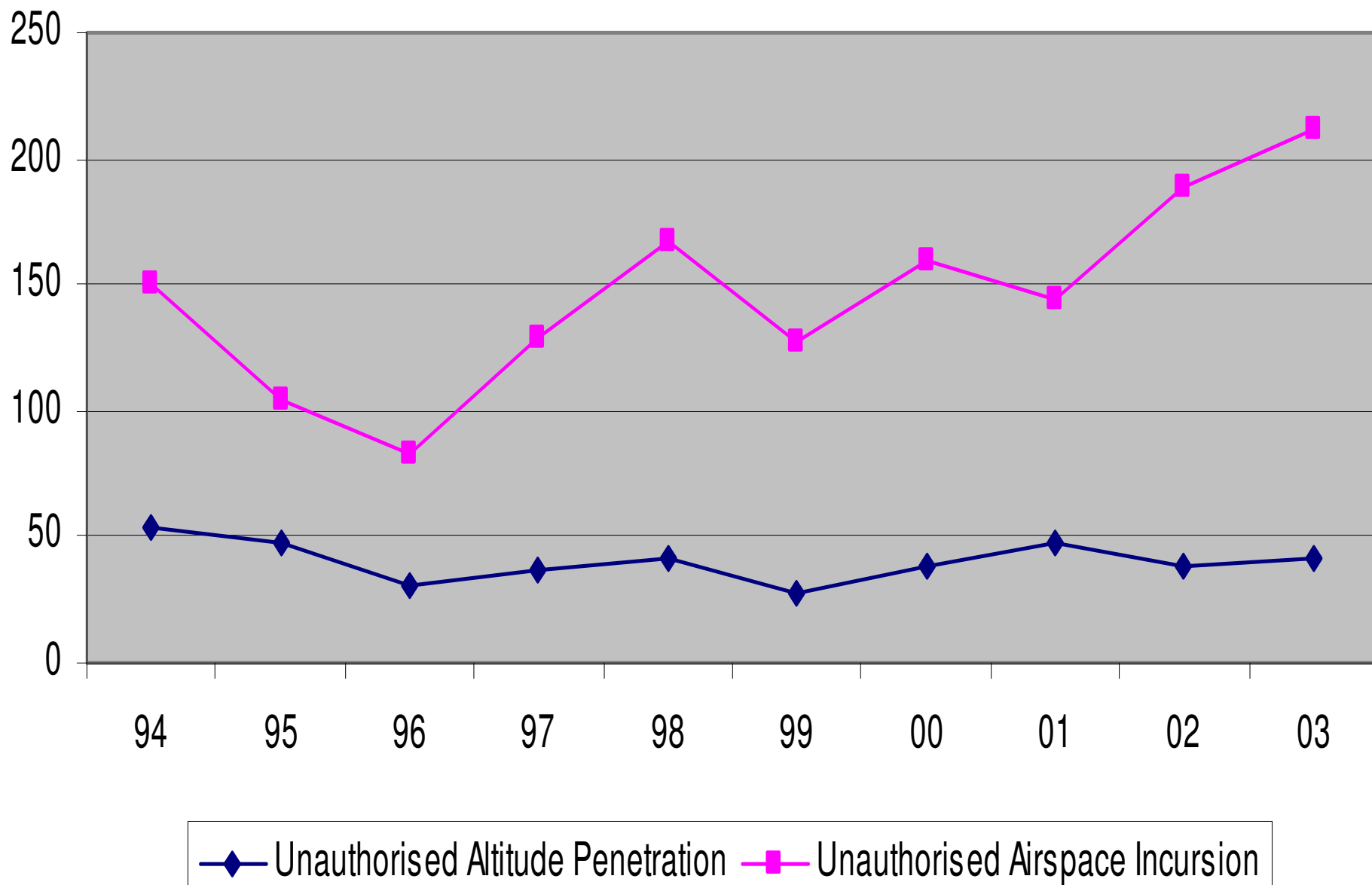


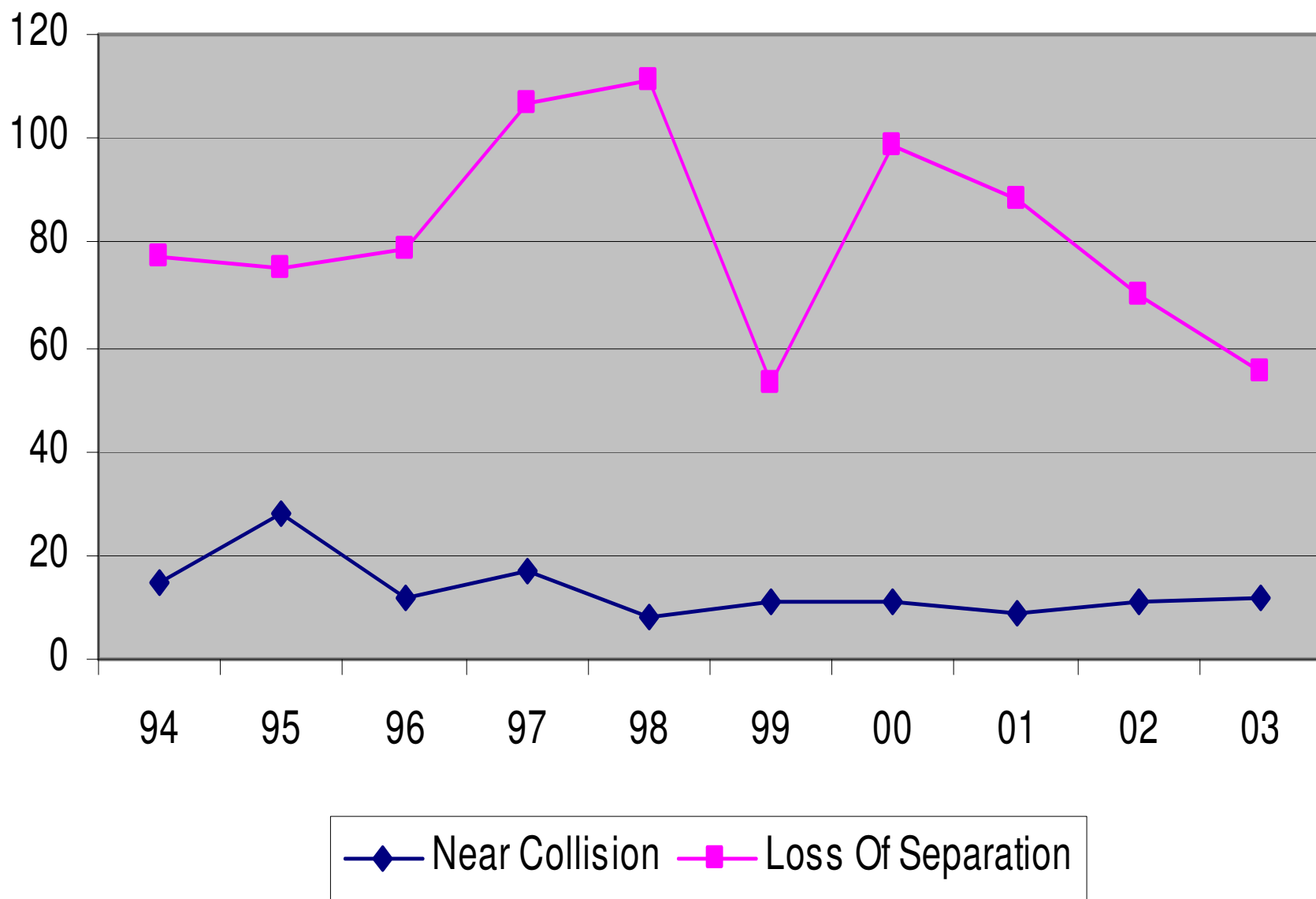
## Airspace Incident - 12 Month Moving Average Pilot Attributable



Airspace occurrence descriptors that are pilot attributable.

•Descriptor	•1 Jul to 31 Dec 2002	•1 Jul to 31 Dec 2003	•Chan ge
•Unauth Airspace Incursion	•99	•100	•+ 1
•Breach of Other Clearance	•37	•55	•+ 18
•Pilot Flight Planning Deficiency	•24	•25	•+ 1
•Pilot Position Reporting Deficiency	•35	•22	•- 13
•Unauth Altitude Penetration	•20	•19	•- 1
•Pilot Read back Deficiency	•3	•4	•+ 1
•Flight Assist	•2	•4	•+ 2
•Total	•220	•229	•+ 9







# Standard Letter

- Dear Sir
- The Civil Aviation Safety Investigation Unit has received an air safety incident report from the Airways Corporation concerning the operation of your aircraft ZK-??? on 16 May 2004 at 22:28 UTC. Details are as follows:
- *P3-Airways reported that the aircraft was observed to enter the OH CTA at 4200ft north of Ohakea and remained therein for approximately 3nm before descending clear of the airspace.*
- It would be appreciated if you could please submit full details on the enclosed Occurrence Report within two weeks of receipt of this letter.
- If you would like to discuss this matter, please feel free to telephone CAA on (04)560-9441.
- Yours faithfully

# Findings

The screenshot displays a software interface titled "Production Database". The main menu bar includes options like Client, Work Request, Entry/Exit, Enforcement, Analysis, Finance, Time, Reporting, Strategic Support, and Help. The active window is "Maintain Findings, Causes and Actions".

**Date Discovered:** 19-Apr-1999  
**Client ID:** [Empty]  
**OR Cost Centre:** [Empty]

**Acft Reg:** [Empty]      **Aviation Document:** [Empty]

**Category:** ☒ NCP   ☐ NCF   ☐ OBS   ☐ SRC  
**Type:** ☐ Critical   ☒ Major   ☐ Minor

**Description:** [Large Empty Text Area]

**Manual Ref.:** [Empty]  
**Rule Ref.:** [Empty]  
**Location:** [Empty]  
**Finding:** [Empty]  
**Exception Text:** [Empty]

**Causes**

No	Cause Text	Person Org	Category	Item ID	Item Text
▶				0	

**Actions**

**Action:** OA0    ☒ Open   ☐ Closed   ☐ Cancelled   ☐ Recheck    **Due Date:** 19-Apr-1999    **Cost Centre:** [Empty]

☒ Corrective   ☐ Preventative   ☐ Recommendation

[Large Empty Text Area for Action Details]

**Responsible Officer:** WHITER

**Registered By:** WHITER    **Registered On:** 19/04/1999 15:02:28

Record: 1 of 1 | Record: 10 of 10

Form View | FLTR | NUM

Brief_Description	Finding_Text	Cause_Text	Item_Text	Action_Text
<p>The medium size aircraft was a flight from T to A and was given a Radar 1B departure that required them to maintain 3000ft until 10 DME TG. The flight was observed by the ? radar controller to climb above this level. The pilot was then instructed to climb to FL130 on track to '?' reporting point. This clearance was not complied with either as the flight was observed west of the required track and in conflict with another medium size aircraft. It is believed that separation was reduced to below the required 3nm .</p>	<p>Captain did not comply with ATC or company procedures for departure.</p>	<p>Pilot did not brief clearance prior to departure and did not realise the hold down requirements</p>	<p>ACTIONS INCONSISTENT WITH PROCEDURES</p>	<p>Captain spoken to regarding the incident and has learned from the experience.</p>
<p>The medium size aircraft was an IFR flight from N to C at FL160. About 45 miles north of C, the aircraft commenced descent without having been cleared, and conflicted with opposite direction traffic another medium size aircraft at FL150. A was given a heading to restore separation and B climbed back to 160 after reaching FL153 on descent. Once past A, B was cleared to descend initially to 11,000 feet.</p>	<p>The aircraft descended from FL160 without a descent clearance and compromised separation with opposite direction traffic at FL150.</p>	<p>The crew forgot to obtain clearance before commencing descent.</p>	<p>ACTIONS INCONSISTENT WITH PROCEDURES</p>	<p>The captain was well aware of the failure and has learned from the experience.</p>



Brief_Description	Finding_Text	Cause_Text	Item_Text	Action_Text
<p>The small aircraft was a VFR flight from Wellington to P. The pilot was given instructions to maintain 1500ft, but misjudged the WN/CTR/C boundary and was observed to climb to 2500ft over Petone without a clearance.</p>	<p>Aircraft climbed above assigned altitude of 1500ft, to 2500ft, within WN/CTR/C without a clearance.</p>	<p>Pilot misjudged his distance from the WN/CTR/C boundary and initiated a climb thinking he was clear of the zone.</p>	<p>INACCURATE SYSTEM "DIAGNOSIS"</p>	<p>The pilot received a comprehensive briefing, (from CFI,) regarding WN CTR, followed by a dual check flight into the control zone.</p>
<p>The small aircraft was inbound to Wellington and was instructed to join left-hand downwind for runway 16. Air New Zealand (B737) was on final for 16. The aircraft turned left west of the Miramar Peninsula and joined on a downwind leg between the VOR and the runway. ANZ was sent around and was given essential traffic information; The small aircraft was instructed to carry out an immediate right turn, and to hold over Ward Island for several minutes before rejoining. The 737 carried out a standard missed approach .</p>	<p>The pilot joined a left low-level circuit inside the Mirimar Peninsula, when the designated circuit is outside the peninsula.</p>	<p>The pilot was not familiar with the visual circuit, having previously flown only IFR into Wellington.</p>	<p>INACCURATE SYSTEM "DIAGNOSIS"</p>	<p>The pilot has undergone extensive briefing and training with his CFI.</p>

Brief_Description	Finding_Text	Cause_Text	Item_Text	Action_Text
<p>The medium size aircraft was forced to take avoiding action around a small aircraft which ascended into the AA (Auckland) TMA from the Ardmore Training Area and without an Air Traffic Control clearance.</p>	<p>The pilot was completing a solo training flight from Ardmore and climbed to 5000feet entering the Auckland TMA without a clearance.</p>	<p>The student who previously completed his training out of Omaka and regularly climbed to 5000ft. He inadvertently entered the Auckland TMA. He was briefed prior to the flight</p>	<p>INADEQUATE CHECKING</p>	<p>The pilot was briefed after the event and completed ground and flight remedial training by a senior instructor.</p>
<p>The medium size aircraft was an IFR flight from NZAA via TM and OHN to NZPM. However the flight followed the track from TM to PM direct at 10,000 when the MSA is 11300ft. The OH Area controller also advised the pilot the flight was about to enter an adjacent radar terrain sector of 13000ft and provided radar vectors until they were clear the sector.</p>	<p>The night training flight from AA to PM made a revised plan due WX. The aircraft was at 10000 feet and was in a 11000 feet radar terrain sector about to enter a 13000 feet sector. ATC intervened and gave radar vectors</p>	<p>The direct track was inadvertently read off the IFR chart instead of the revised plan track. The instructor/pilot also advised that he normally flew the route in a pressurised aircraft.</p>	<p>INADEQUATE CHECKING</p>	<p>Manager Flight Operations has counselled the PIC on adherence to SOP's even though training a student who was very challenging and had language problems.</p>

Brief_Description	Finding_Text	Cause_Text	Item_Text	Action_Text
<p>A medium aircraft was given descent clearance to 5000 feet, on the 272 radial. At the same time another medium aircraft was given a diversionary climb on the 296 radial and to maintain 4000 feet. However, A reported being at 11 miles at 4,200 feet and requesting a visual approach. B's climb was stopped at 3000 feet and A was told to maintain current altitude. A then reported sighting B outbound at 600 feet above, at its 9 O'clock position (relative), and confirmed B had passed.</p>	<p>A was given descent to 5000 feet via the DME steps but inadvertently descended towards B</p>	<p>PIC failed to observe standard operating procedures namely the use of the checklist. Also failure to write down clearance limits.</p>	<p>POOR PROCEDURE "ACTION"</p>	<p>The pilot has undergone remedial training .</p>
<p>A small aircraft was arriving at Wellington via the Makara Sector when the aircraft strayed from the area and infringed the final approach track for runway 16 while a Boeing 737, was on a 7 mile final.</p>	<p>A strayed out of the Makara sector.</p>	<p>Slowness to respond to a changed ATC instruction due to being almost on the new reporting point when requested to hold west of it.</p>	<p>POOR PROCEDURE "ACTION"</p>	<p>Pilot completed a briefing concerning Wellington control zone approach and reporting points.</p>

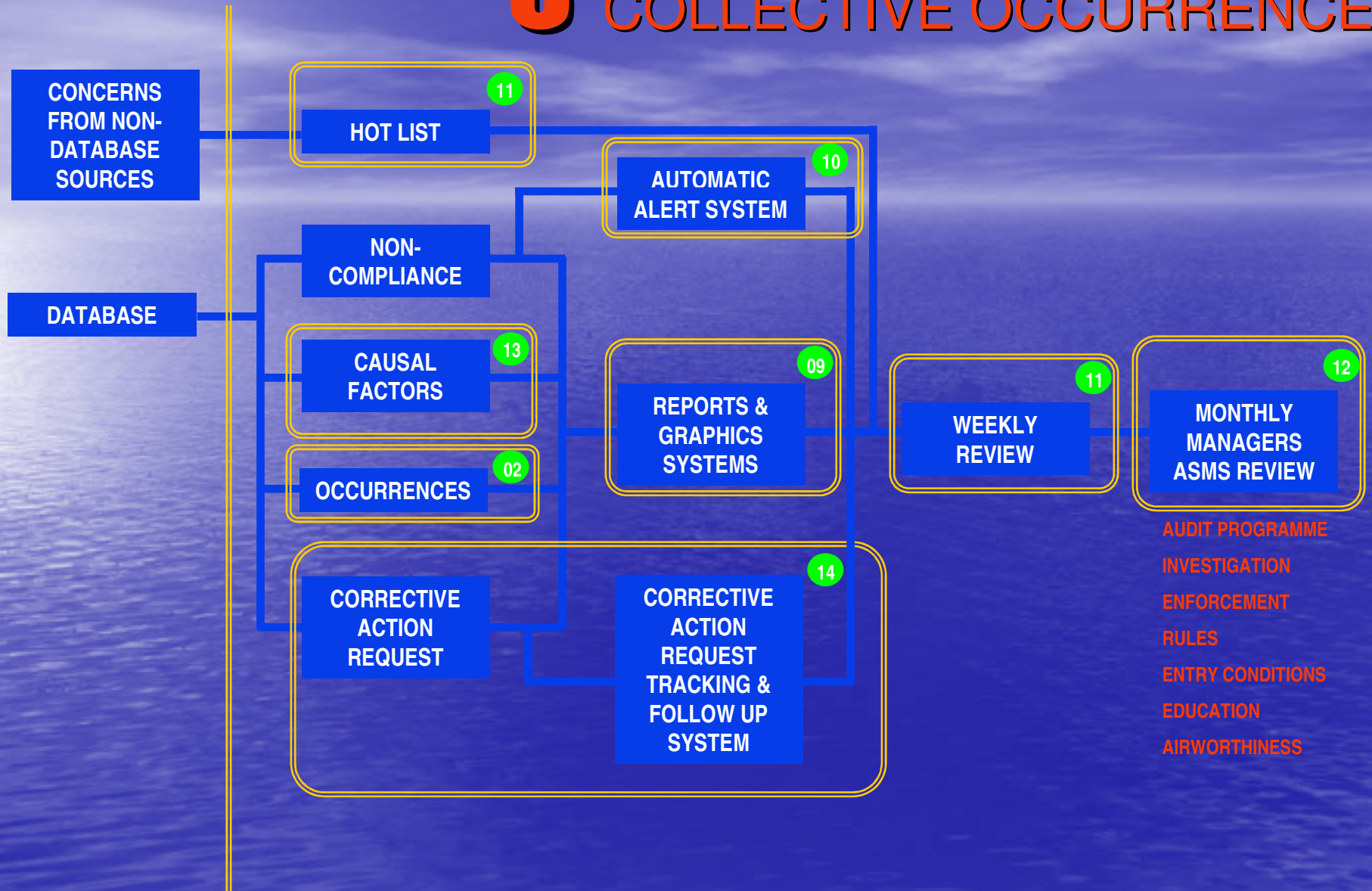
Brief_Description	Finding_Text	Cause_Text	Item_Text	Action_Text
An aircraft was observed outside navigational tolerance and below minimum terrain altitude at PP. ATS assistance was given. Pilot also had difficulties establishing on the instrument approach into Wellington and was observed to descend below profile on the approach. This aircraft was also observed to fly very low by members of the public.	A was observed to descend below profile on the ILS/DME approach to Wellington Airport.	The pilot had elected to carry out an auto pilot coupled ILS Approach to allow time to complete approach checks and was not aware of descent below approach profile.	STATE CHANGE NOT DETECTED "INFORMATI ON"	The pilot received remedial training and an IFR competency Flight Test. The company published an operations supplement regarding the use of, and training required for Auto Pilot Coupled Approaches.
A large aircraft climbed through assigned level and separation broke down with QF. A was vectored after departure from Runway 34L towards track. The aircraft was turned east about 10nm northwest of SY and assigned A 070 underneath diverting aircraft inbound to SY from the north. A STCA alarm was received and the radar indicated that A was A072 traffic was passed on to QF. A climbed to A O73 before descending back to assigned level.	Minor altitude infringement during departure.	PFs adaptation to the varying aircraft response over a short climb with other distractions .	STATE CHANGE NOT DETECTED "INFORMATI ON"	It was considered that this was a minor deviation to be expected very infrequently in transition training. The general preference for autopilot departures remains.

Brief_Description	Finding_Text	Cause_Text	Item_Text	Action_Text
<p>An instructor on board a light aircraft reported on a near collision with Cessna 172 near Ardmore while climbing out to Ardmore Training Area. Evasive action was taken by the reporting pilot.</p>	<p>A was involved in a near collision with B while joining at Ardmore Aerodrome.</p>	<p>The PIC of A was new to instructing at Ardmore and was unaware of the preferred arrival and departure procedures agreed to by the local CFI's</p>	<p>TASK UNFAMILIARITY</p>	<p>The preferred routes for Ardmore traffic were incorporated in the January 2002 VFG Change notice. Instructor in A was also briefed on agreed routes.</p>
<p>A large aircraft had been cleared to descend to 11000 ft in the vicinity of Tory VOR while a medium aircraft was in transit beneath at 10000 ft. A was observed to descend to 10600 ft thus infringing the separation between the two aircraft, which was reduced to less than the required 3 nm horizontal separation. The captain reported that he had started resetting the altimeter from 1013 to the QNH of 989, passing (about) FL122. He realised with the large QNH change and the rate of descent that the aircraft might not level.</p>	<p>The aircraft descended below the cleared level of 11,000 feet thus infringing separation on traffic at 10,000.</p>	<p>A large change in the altimeter setting (from 1013 to 989) coupled with the aircraft's high rate of descent resulted in an overshoot of the preset level.</p>	<p>TIME SHORTAGE</p>	<p>The captain was well aware of the failure and has learned from the experience.</p>

## Dominant factors for pilot caused airspace incidents.

INCIDENT	DOMINANT FACTORS		
	Active	Local	Organisation
<b>Unauthorized Airspace Incursion</b>	Actions inconsistent with procedures, i.e. execution errors.	Inadequate checking, risk misperception, and inexperience.	Poor planning
<b>Unauthorised Altitude penetration</b>	Actions inconsistent with procedures, i.e. execution errors.	Inadequate checking, high workload factors, and poor concentration/ lack of attention factors	Inadequate control and monitoring
<b>Near Collision</b>	Diagnosis, Procedural and actions inconsistent with procedures, i.e. execution errors almost equal.	Inadequate checking, interpretation difficulties.	Not Enough Data
<b>Pilot Position Reporting Deficiency</b>	Not Enough Data	Inexperience.	Not Enough Data
<b>Breach of Other Clearance</b>	Inaccurate system diagnosis, i.e. diagnostic errors.	Inadequate checking and interpretation difficulties.	Not Enough Data
<b>Flight Assist</b>	Not Enough Data	Inadequate checking	Not Enough Data
<b>Pilot Flight Planning Deficiency</b>	Not Enough Data	Risk misperception and poor concentration/ lack of attention.	Not Enough Data

# SAFETY CONTROL PROCESS: COLLECTIVE OCCURRENCES





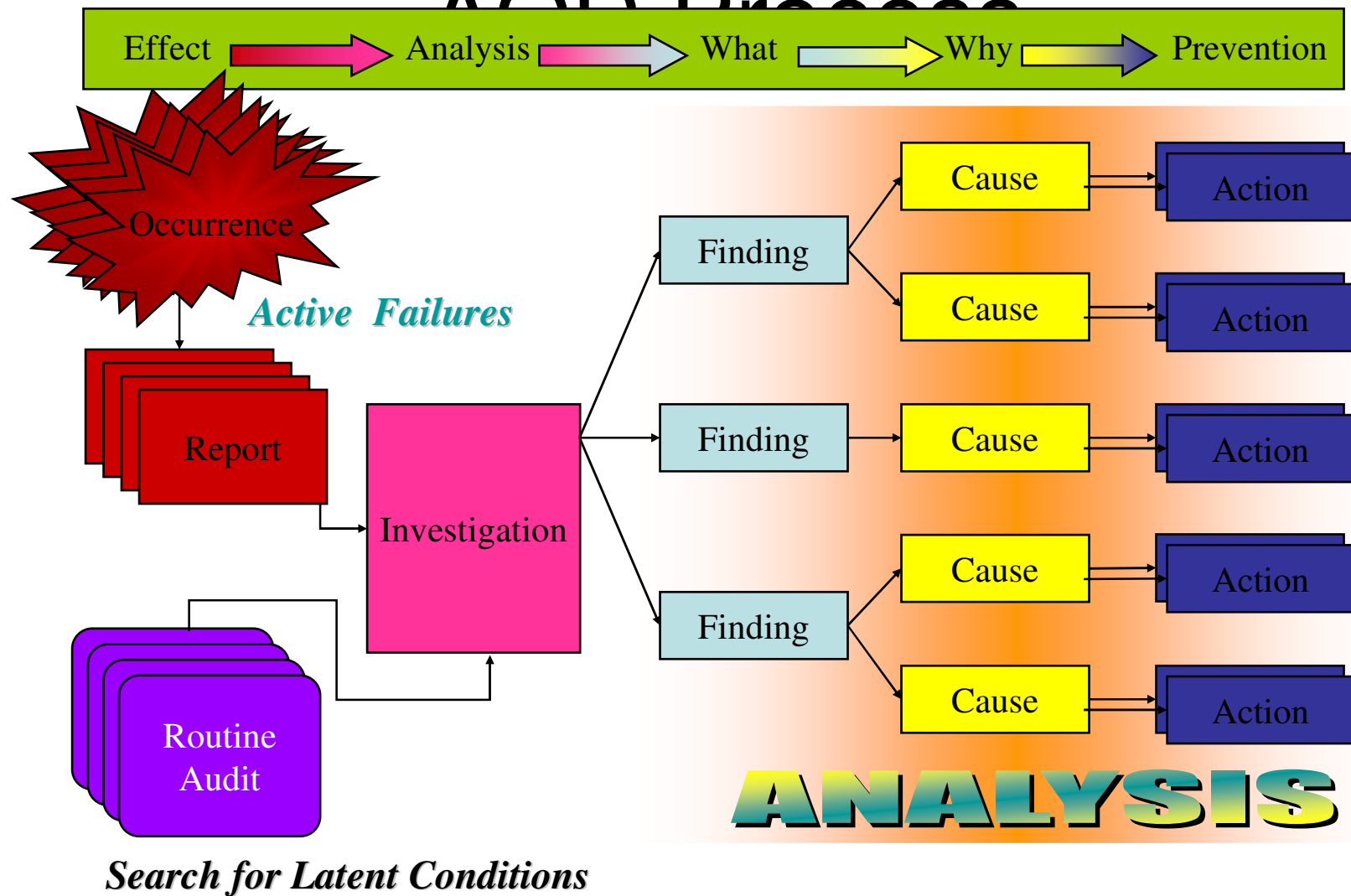








# Causal Factor Analysis - The



# James Reason quote

*“Data without a theory is like a body without a skeleton.”*

*All you can do is carry it around in a bucket.”*



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