

Incident #	Date	Start Time	Total Time (hours)	Corrective downtime (hours)	Preventive downtime (hours)	Delay time (hours)	Problem	Cause	Device (Location)
A6	12/7/2004	?	2.75		2.75		Hardware replacement (SAN disk array controller)		SAN
A7	12/14/2004	?	2.42		2.42		Hardware replacement (SAN CPU and cache modules)		SAN

The counts of incidents by problem type are listed in Table 4-2. Table 4-2 shows that some incidents had multiple types of problems.

**Table 4-2. Counts of Incidents by Problem Type**

Problem Type	Count
Software	9
Human or procedure	7
Hardware	6
Interfaces (workstation-server communications or networking)	3
Database configuration	1

A more detailed classification of incident types can be found in Table 4-3.

**Table 4-3. Classification of Incident Types**

Incident #	Downtime (Hour)	CAD				RMS (H/W)	SAN (H/W)	SNA Gateway (H/W)	Workstation-Server communication	Human or procedure error
		Software	Hardware	DB Config	Admin					
(System went live and the acceptance test period started on 23 Sep 2003.)										
B1	0.23	x								Northrop Grumman
B2	0.08	x								
B3	0.28						x			Northrop Grumman
B4	0.45	x								
B5	0.25	x						x		
B6	0.12	x						x		
B7	0.62	x								
B8	0.25		x							
B9	4.38	x				x				
B10	0.98	x				x				
(System was accepted on 1/2/2004)										
A1	3.18			x						Northrop Grumman
A2	0.90	x								
A3	12.00				x					Northrop Grumman
A4	5.00						x			HP

Incident #	Downtime (Hour)	CAD				RMS (H/W)	SAN (H/W)	SNA Gateway (H/W)	Workstation-Server communication	Human or procedure error
		Software	Hardware	DB Config	Admin					
A5	8.00						x			HP
A6	2.75						x			
A7	2.42						x			

Incident B1 (9/24/2003). The outage was caused by an incompatible software upgrade and is not likely to occur again if configuration requirements are carefully processed.

Incident B2 (9/30/2003). The outage was a software bug in an analysis program that is not critical to call processing and dispatching. Portions of the program were temporarily disabled and are not likely to cause future outage.

Incident B3 (10/2/2003). The outage originated from a bad network card at the backup SNA gateway. This is regarded as a single point of failure. Unless fault isolation is considered, whether in the architecture or at the application level, this kind of outage may happen again.

Incident B4 (10/8/2003). The outage was caused by a system deadlock for database transactions. This was fixed with a code change.

Incidents B5 (11/5/2003) and B6 (11/7/2003) are the same kind of outage. CAD had more than 800,000 TCP packets pending transmission/retransmission from CAD to a remote workstation at 61 Riesner. This large amount of communications backlog caused CAD to go down. The resolution was to limit the amount of data that could be requested at one time from each workstation. Users needing large amounts of data would have to do queries outside of CAD; e.g., using SQL on database server. This problem should not occur again, but the root cause of CAD ability to operate when large communications backlog happens may still be a problem. A better understanding of capacity limits will help develop fault detection and performance monitoring capabilities.

Incident B7 (11/10/2003). The outage was caused by an archive logging process error. This problem should not occur again if the correct procedures are followed.

Incident B8 (11/16/2003). This was the only CAD hardware (memory module) failure. Reoccurrence is dependent on the hardware reliability.

Incidents B9 (11/28/2003) and B10 (12/3/2003). Both outages had the same symptom: incomplete transactions between RMS and CAD or the failure of RMS to report completed transactions caused the integrated database locked. Manual unlock was done by support

