

**ICL
Pathway**

**Acceptance Incident 298 – Resolution
Plan**

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Version: 0.8
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Abstract: This document contains ICL Pathway's updated resolution plan for Acceptance Incident 298.

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0 Document control

0.1 Document history

Version	Date	Reason
0.1	20/8/99	Initial draft for comments
0.2	24/8/99	Version for the Expert and workshop 26/8
0.3	2/9/99	Redrafted as a resolution plan
0.4	9/9/99	Material added on longer term incidence rates and defect prevention for future releases; distributed as a draft at Acceptance Workshop 9/9/99
0.5	10/9/99	Statistics updated to CAP 24; amendments to show statistics by counter volumes as a result of Acceptance Workshop 9/9/99
0.6	16/9/99	Summary & outline forward projections added to Section 5.2.4; additional material incorporated into Section 5.5, following review with POCL
0.7	22/9/99	Section 5.4.4 updated to reflect agreement on monitoring process during Oct/Nov. <i>[DN: Partial results for CAP26 have been included in this draft and should be disregarded.]</i>
0.8	23/9/99	Further updates arising from drafting of Schedule 2 Part A of the second supplementary agreement

0.2 Approval authorities

Name	Position	Signature	Date
J H Bennett	Managing Director		
J C C Dicks	Customer Requirements Director		
T P Austin	Development Director		

0.3 Associated documents

Reference	Vers	Title	Source
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0.4 Abbreviations

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ICL Pathway **Acceptance Incident 298 – Resolution Plan**Ref: CR/ACD/298
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1	PURPOSE.....	5
2	SUMMARY	5
3	CRITERIA.....	5
4	POCL POSITION	5
5	PATHWAY POSITION	6
5.1	PATHWAY WORK PROGRAMME.....	6
5.1.1	Short- Medium Term Activities	6
5.1.2	Medium-Long Term Activities	6
5.2	STATISTICS FOR THE PERIOD SINCE 29 JULY	6
5.2.1	High level analysis	6
5.2.2	System Load Events & “Unauthorised” Reboots.....	7
5.2.3	System Incident Metrics	7
5.2.4	Summary Position (CAP 25) & Future Projections	10
5.3	DETAILED INCIDENT ANALYSIS, CATEGORISATION & RESOLUTION.....	13
5.3.1	Button No Entry Signs.....	14
5.3.2	Suspense Account Print.....	14
5.3.3	Virtual Memory Problems	15
5.3.4	Printer Hanging	15
5.3.5	Freezing during /after log-on.....	16
5.3.6	F1 Twice during log-on.....	17
5.3.7	System Busy Message.....	17
5.3.8	Query Logged-on Users Message	18
5.3.9	Miscellaneous Freezing / Usage.....	19
5.3.10	Counter Printer problems	19
5.3.11	APS Problems	20
5.3.12	OBCS Problems	20
5.3.13	Counter Printer Busy Problems	21
5.4	RESOLUTION OF INCIDENT METRICS	21
5.4.1	Contractual Requirements	22
5.4.2	Comparison against Industry Norms	22
5.4.3	Acceptance Position.....	22
5.4.4	Resolution Proposal.....	22
5.5	IMPROVED DEFECT REMOVAL FOR FUTURE RELEASES	24
5.5.1	PINICL Analysis	24
5.5.2	Implications for CSR+	27

1 Purpose

This paper seeks agreed ways forward to resolve the system instability issues.

2 Summary

Pathway presents for review the relevant statistics for the period since 29 July, with particular reference to System Load Events; the progress to date at a detailed level; and the approach to future measurement, which it is proposed will involve POCL.

3 Criteria

The Criterion cited is 536/1.

“peripheral and input devices supplied as part of the elements of the Service Infrastructure on which OPS is provided shall be reliable, robust and easy to use”.

4 POCL position

Based upon the minutes of the Acceptance Board Meeting of 18 August 1999, POCL contended that:

“the proposed rectification plan does not provide an understanding of how the problems will be resolved by the proposed fixes. It is also unclear when fixes will be implemented”.

“POCL would need to see the outturn of [the fixes] as this was the only way to confirm the impact of the changes”.

“evidence from ringarounds suggested the problem could be 50% higher than reported at the help desk and that there was no clear evidence from Pathway to confirm or deny this”.

At the Acceptance Workshop on 6th September POCL introduced a proposed metric of 1 system “lock-up” or “crash” (requiring reboot) per counter PC per annum. This is based upon the achievement of a 95% reduction in stability incidents reported against week 19 and is said to be broadly in line with system stability statistics from ECCO and ALPS.

5 Pathway position

5.1 Pathway work programme

5.1.1 Short- Medium Term Activities

The ICL Pathway programme of work to stabilise the current level of system comprises root cause analysis and resolution of system incidents:

- detailed examination of Horizon System Help Desk call records
- direct telephone contact with post offices to more fully understand the detailed nature of the problem as seen by the users
- reconstruction and analysis of problems within Pathway test systems
- testing and automated distribution of fixes as described in the Acceptance Incident Analysis of 17 August

The details of this work programme are provided in Section 5.3, which gives an analysis of the various system stability faults by category, along with details of fixes applied and associated incidents levels pre- and post-fix.

5.1.2 Medium-Long Term Activities

In parallel with this short term activity, a thorough review of the detected faults is underway to ascertain their nature and to identify what changes may be appropriate to the ongoing Pathway development and testing approach. Section 5.5 of this document provides details of the analysis already undertaken in this respect, the initial conclusions and suggestions for improved defect removal for future releases.

5.2 Statistics for the period since 29 July

5.2.1 High level analysis

The principal measure of systems instability has been the calls made to the Horizon Systems Help Desk by outlet staff reporting a problem with the functioning of the system at the outlet.

For a proportion of such calls the incident is resolved by a system unit reboot (a Help Desk “authorised reboot”). In other cases the Help Desk staff may recommend an avoidance action that provides a simple workaround to the problem without rebooting the system unit. In certain cases the Help Desk may also receive a call from an outlet advising that outlet staff have locally initiated a reboot; such calls are recorded by the Help Desk and normally provide some additional information relating to the circumstances of the incident.

5.2.2 System Load Events & "Unauthorised" Reboots

POCL expressed concern over the potential occurrence at outlets of locally initiated system unit reboots that had not been reported to the Help Desk. ICL Pathway subsequently mounted an exercise to extract this information by extracting and analysing the Windows NT System Event Logs at each outlet. This provides precise statistics for all System Load Events (SLEs) whatever their cause. By correlating these load events with reboot instructions issued at the Help Desk it has been possible to produce metrics for both authorised (via HSH) reboots and unauthorised (via local office action) reboots. This analysis is continuing on a day by day basis.

Such unauthorised reboots may occur for a variety of reasons, including:

1. in response to a perceived systems malfunction of some kind, where the clerk does not contact the Help Desk and initiates such action of his own volition
2. in response to an environmental incident such as a power cut or through disconnection of the power supply
3. through failure to leave the machines switched on during periods of unattended operation (e.g. overnight or weekends) with corresponding reboots when operation restarts, e.g. on a Monday morning

Since the circumstances relating to such incidents are unknown, the incidents cannot be directly attributed as systems stability incidents and must be excluded from the detailed analysis in the following section. Both POCL and ICL Pathway are working to reduce the incidence of such reboots to the core unavoidable events (category 2) through improved user education and discipline.

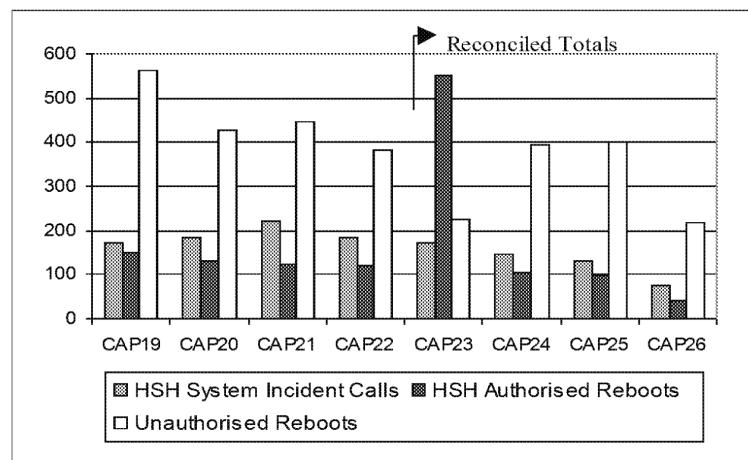
5.2.3 System Incident Metrics

The high level analysis of system instability incidents thus includes three categories:

- Authorised reboots (correlated with Help Desk instructions)
- Unauthorised reboots
- Total Help Desk system incidents (including authorised reboots and other calls closed via avoidance actions)

Summary totals for the Cash Account Periods 19-26 are shown in the following charts

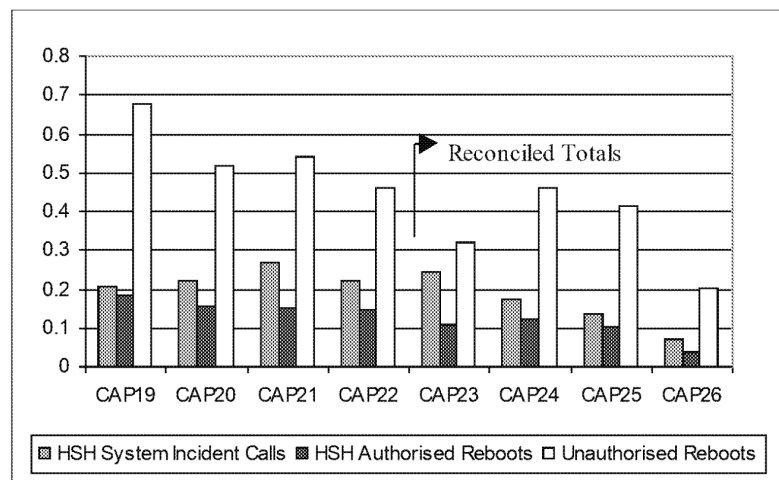
(Note that the total for CAP 26 is provisional and the final figure may be subject to minor variation once all incidents from the 22nd September have been fully analysed.)



Note that (i) CAP23 included a Bank Holiday and a planned (authorised) reboot of all counters, by request to outlets; (ii) “unauthorised” reboots have increased in CAP24 and CAP 25 due to the installation of new outlets showing up in the total. (This trend is expected to continue.)

A more detailed scheme of incident analysis was instigated by Pathway from CAP23, to facilitate focused incident analysis and resolution. This places emphasis on that class of incidents which requires a system reboot. From week 24 an individual reconciliation of incidents totals between Pathway and POCL has been occurring with inclusion of a category for “disputed” items which involve an HSH call but not a reboot. For week 23 a retrospective adjustment has been added to the weekly total to support comparison between the two weeks. However, direct comparison with earlier weeks is not valid since the totals were not reconciled in this way.

The following chart shows the same data, with the planned reboot data removed (31/8/99), CAP 23 adjusted for the bank holiday in terms of incident rate per day, and the numbers for each week adjusted for the volume of counters installed. This shows the incidence of the same measurements expressed as a rate of occurrence per counter per week.

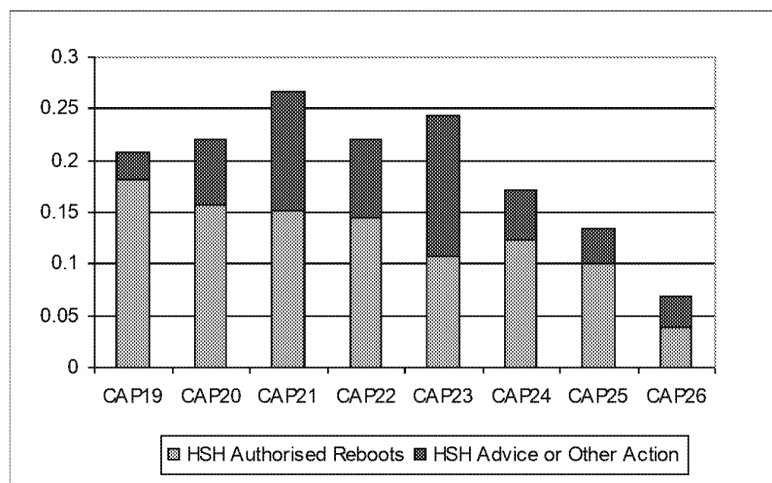


From the above analysis it can be seen that there is a reducing trend, particularly towards the end of the current period. The chart following shows the incidence of

HSH calls per counter per week relating to systems incidents. The level of HSH (authorised) reboots is now at the level of approximately 0.5 per month per counter, below the first Pathway target (1.0) and the proposed threshold for classification as medium severity.

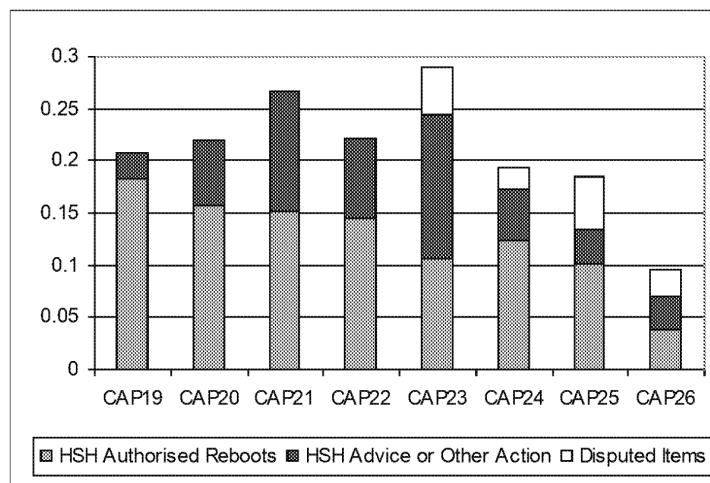
The increase in incidents in CAP 23 is attributable to the introduction of the “System Busy” indicator and a one-off fault introduced into OBCS which both resulted in a significant number of new calls.

The following chart shows the HSH system incident calls separated into those requiring a system reboot and those dealt with by advice or other action.



A number of analysed HSH calls have not been resolved between ICL Pathway and POCL and are listed as disputed incidents. Such calls include simple workarounds to known (predictable and stable) operational problems, and a few other incident types, such as handling of printer jams and related printing conditions, which have not been accepted by ICL Pathway as indicative of a system stability problem. The following chart includes the above totals with disputed items shown as a separate category.

The principal incident in the disputed category is that of button locking (see *section 5.3.1*). *Section 5.4.4* makes it clear that for the period of monitoring, those button locking incidents that result in reboots or authorised workarounds will be counted. HSH calls other than those, which result in reboots or workarounds due to button locking, will not be monitored after CAP26.



5.2.4 Summary Position (CAP 25) & Future Projections

The incident types have been grouped into 13 categories and a detailed analysis is provided in section 5.3.

Problems Eliminated

The following incident types have been eliminated with no noted recurrences:

- Back office printer hanging on final cash account production (Section 5.3.4)
- The “one-off” OBCS problem (Section 5.3.12)
- Querying logged-on users problem (Section 5.3.8)
- Improvements in performance of the suspense account print (Section 5.3.2)

Problems Significantly Improved

The following incident types have seen significant improvement but have not been totally eliminated

- Button locking problems (Section 5.3.1) have been reduced to a small number of incidents, which can be avoided by workaround.
- Virtual memory and other error messages (Section 5.2.3)
- APS application problems - associated with printing and recovery (Section 5.3.11)

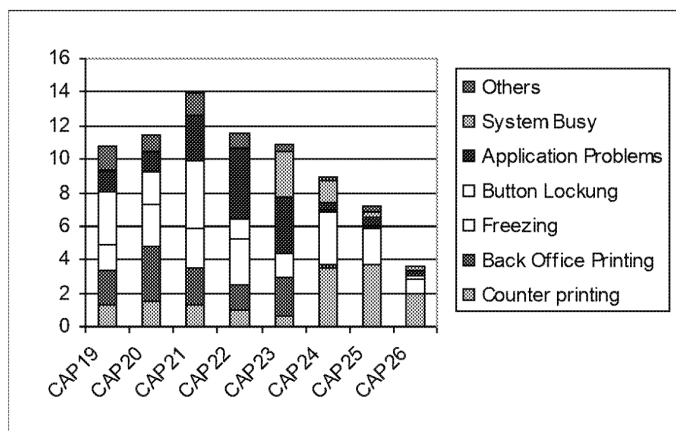
Key Outstanding Problems

The following problem areas have seen only minor improvements and are the principal subjects of current analysis and fixes:

- Freezes during / after log-on and occasionally in other circumstances (Sections 5.3.5, 5.3.6 & 5.3.9)

- Counter printing issues (Sections 5.3.10 & 5.3.13)
- System Busy incidents (Section 5.3.7), although these are being re-categorised into the underlying problems

The history of the main types of incident is shown in the chart below, shown on the same scale as individual incident rates in section 5.3 (incidents occurring per counter per annum). This indicates the history of when significant systems problems have been experienced and eliminated.



This chart shows that the three significant incident categories as of CAPS 24-26 are counter printing, system freeze conditions and system busy. (It is also apparent that various AP problems in CAPs 19-23 were related to counter printer incidents, giving rise to an understatement of such printer conditions during these weeks.)

Future Incident Rates

These are based upon an assessment of the current known problem areas with fixes either in preparation or distribution, plus an expectation of smaller “second phase” improvements in the longer term to tackle residual incident types in significant categories.

The main short term fixes assessed include:

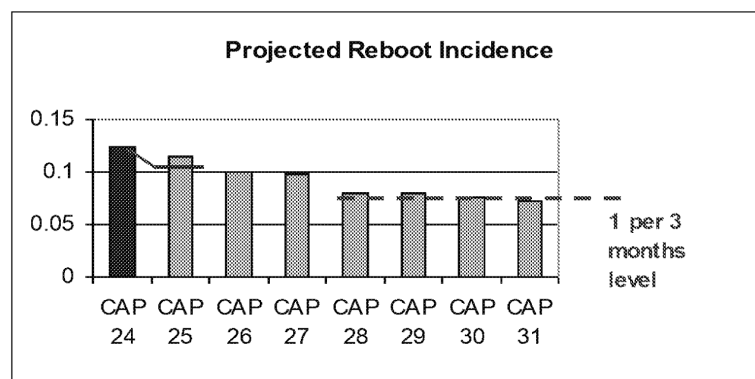
1. The “Double F1” fix to relieve system freezes during log-on (week 25) plus diagnostic to provide more details of other freeze conditions (should reduce 40-50% of freeze conditions)
2. The fix to the Riposte Peripheral Server and related incidents involving 2nd page GIRO reports
3. Elimination of print contention by locking “Previous” during print format operations

(2 & 3 should eliminate up to 50% of counter printing incidents and are expected in CAP 26/27)

4. Alleviation of button locking problems when an EPOSS receipt is printed after an APS receipt (should avoid workarounds for a substantial subset of incidents) – issued in CAP 25
5. A revised version of System Busy based upon Riposte Desktop processor time rather than total system time (this should eliminate some instances where system busy is active because of background tasks rather than mainstream counter operations) – issued in CAP 25

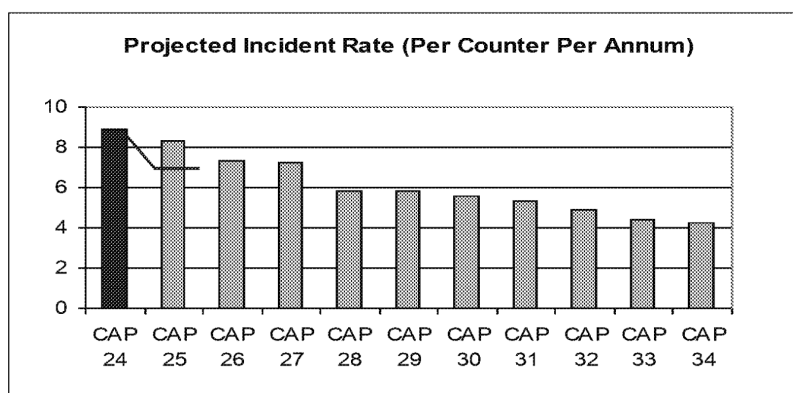
The future projections are separated into near term values for CAP 26 and 27, based upon extrapolation of the HSH authorised reboot levels, and a set of medium term values based upon system incident rates. All projections were made during CAP 25 based upon the actual field data obtained up to and including CAP 24. The (provisional) actual figures for CAP 25 are also shown.

Near Term Projections



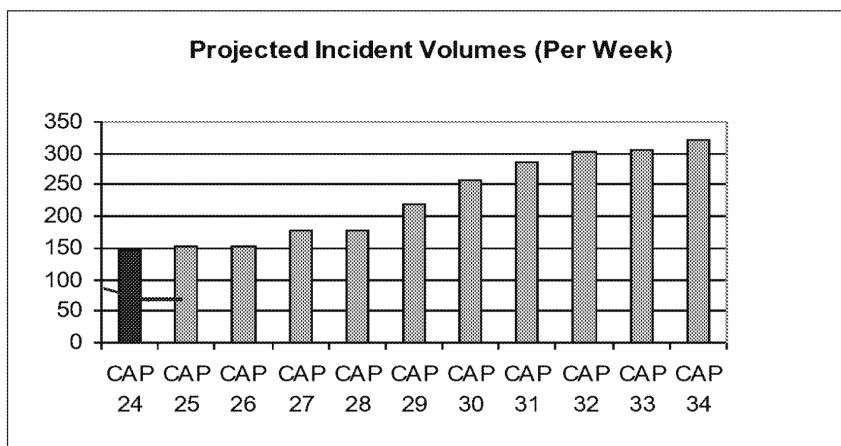
Medium Term Projections

A similar chart for systems incident rate and an extrapolation for actual HSH call volumes are shown below.



The single most significant drop is associated with counter printing fixes expected for issue during CAP 26/7 and showing in the projection for CAP 28.

Taking account of the projected increase in counter population this leads to the following outline profile of incidents at the HSH.



The projected incident rate remains essentially stable over the near term with reductions matched by increased counter volume; during October and November there is a steady increase as the rate of counter build up exceeds incident reduction rate.

5.3 Detailed Incident Analysis, Categorisation & Resolution

To facilitate analysis and resolution, system incidents have been filtered into individual categories, each typically associated with one particular problem area of system operation. To provide confidence in the improving stability of the system, incidents are recorded as daily totals within each category, to allow correlation against the dates at which particular fixes were issued to resolve specific problems. This analysis includes all system stability incidents whether resolved by a system reboot or by procedural workaround.

As detailed investigation of incidents proceeds, certain faults may be grouped together into a new category. Initially 12 categories were identified. At week CAP24 a number of system busy incidents (category 7) have been categorised differently as the detail of the fault has been understood. Certain incidents previously recorded under “system busy” have been identified as hang during/after log-on (category 5) and a specific problem associated with the counter printer during busy conditions has been created (category 13).

From version 0.5 of this document, the incident count has been based against the number of counters installed and quoted as average incidents per counter per annum.

5.3.1 Button No Entry Signs

From time to time under normal system operation Horizon buttons are “locked” to prevent user entry to the particular function at that point in the menu navigation. Such

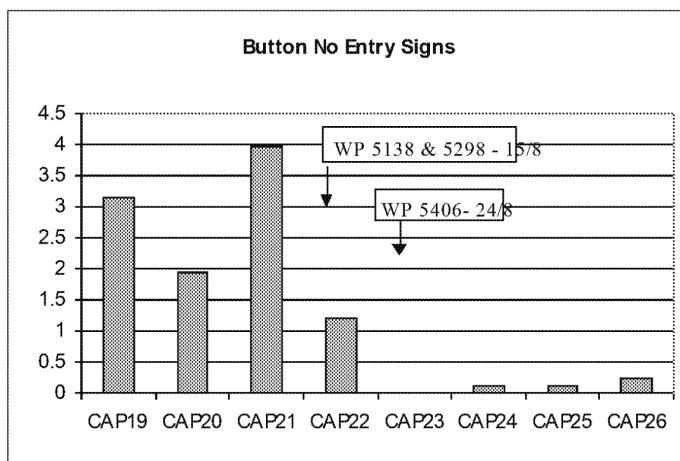
locked buttons are represented to the user by a “no entry” sign across the button. Examples of legitimate usage of locked functions include:

- prevention of more than one user selecting cash account functions or producing certain types of daily printed report
- prevention of logout or entry to training mode when a suspended session exists

At LT2 substantial changes were made to button locking particularly to prevent access to conflicting functions during cash account and printing functions. The logic associated with button locking is complex and typically requires combinatorial analysis of multiple conditions.

Fixes were issued to correct the majority of incidents recorded within this category, by correcting the complex logic associated with button locking. A minor residual usage problem has been identified, which results in button locking if the printer goes offline immediately following a SU balance report. This problem has a simple workaround and does not require a reboot.

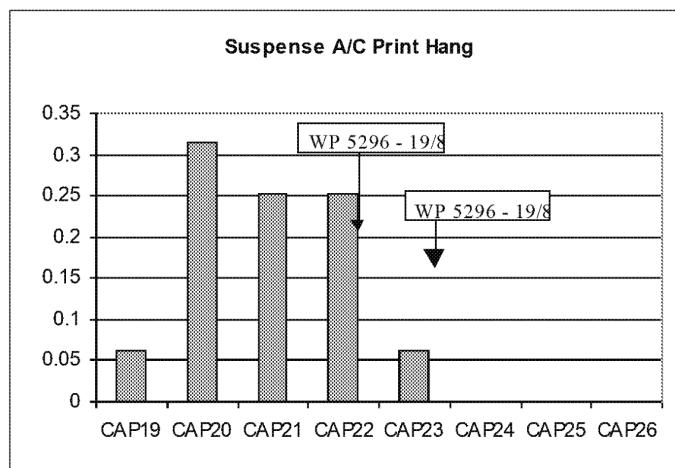
The history of button locking incidents is shown below.



Note that reported incidents tend to be higher on cash account days because of a higher incidence of legitimate button locking associated with cash account and office printing functions. A number of disputed items (incidents which do not require reboot) are excluded from week 23/24. With these included the average incident rate is running at approximately 1 – 1.5 per counter p.a.

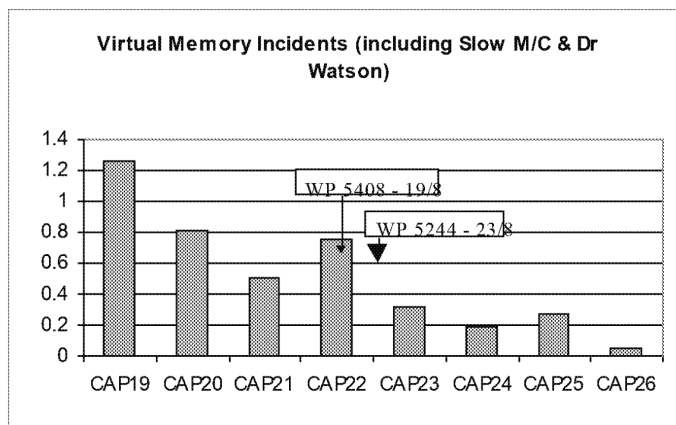
5.3.2 Suspense Account Print

The suspense account was taking an excessive time to print under certain circumstances, giving the appearance of a system hang. A fix to improve the performance was issued in two parts. The history of such incidents is provided below.



5.3.3 Virtual Memory Problems

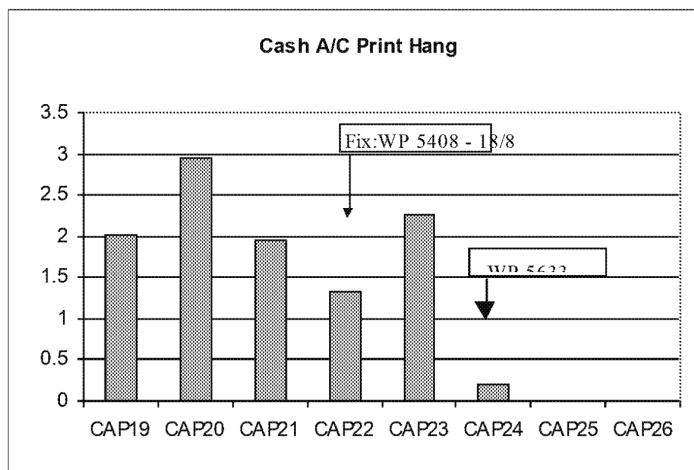
Two problems have been observed which result in progressive memory leakage. (In these circumstances application routines are obtaining virtual memory from Windows but not freeing it correctly after use, leading to eventual virtual memory exhaustion.) The reported symptoms include very slow system operation, virtual memory messages being displayed and, occasionally a Windows shutdown and reboot. The principal problem was memory leakage associated with the Print Monitor routine, which resulted in a substantial loss of virtual memory during print operations. This was fixed in WP 5408. A further residual, but relatively minor, problem associated with the cash account reprint function has been diagnosed. A fix (lower priority) will be issued for this in the future.



5.3.4 Printer Hanging

Several problems were detected which result in back office printer hang-ups under various specific circumstances. A fix for one class of problem, associated with memory leakage, has already been distributed as part of WP 5408. This has reduced the average incidence of such hang-ups. A second problem associated with printing

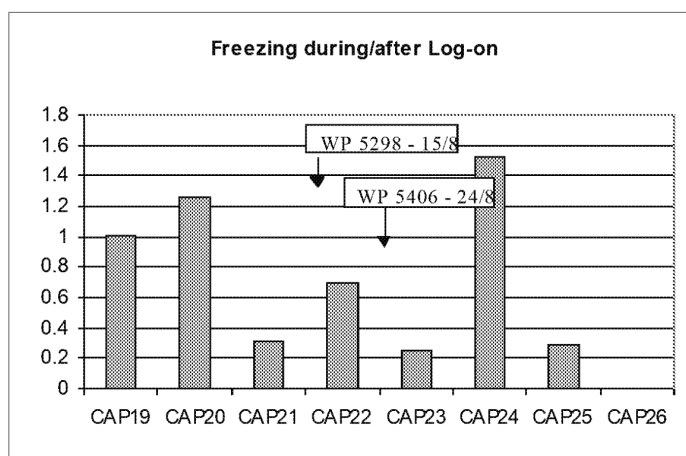
the 2 final copies of the cash account was identified, using results obtained from a diagnostic fix distributed to the live estate. The fix to the cash account print routine was issued on the 7th September. There have been no occurrences during the following two weeks (CAPs 24 & 25)



The residual count shown under CAP 24 relates to incidents from Thursday 2nd September.

5.3.5 Freezing during /after log-on

A number of incidents were observed in which the system froze after user log-on to Riposte. On detailed investigation these were all connected with the Riposte (35 day) message archiving procedure. After log-on various Riposte checks are called to trace message sequences for integrity and (potential) recovery requirements. It was found that certain of these routines were attempting to check message sequences which lay beyond the message archiving window, resulting in system lock-up when the messages could not be accessed. Three fixes were issued covering APS recovery routines and Stock Unit checking.

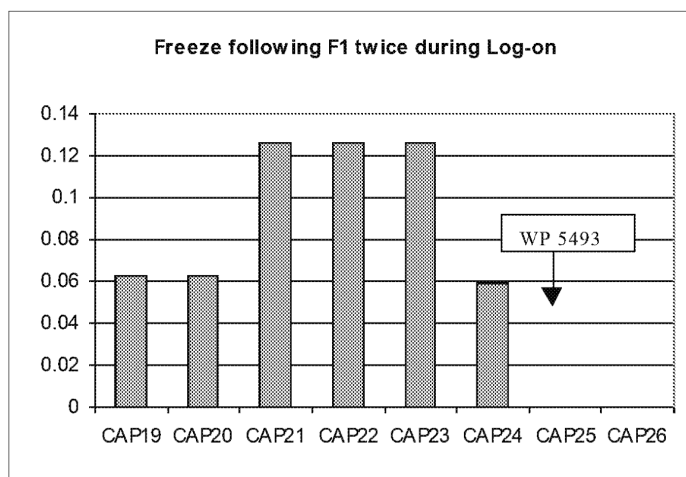


An occasional occurrence of freezing during log-in (prior to entering Riposte) has also been detected and this residual error is under investigation. Some instances of System Busy incidents have been discovered to relate to freezing after log-in, which accounts

for the significantly higher incident rate in CAP 24. Note that the “Double F1” problem (immediately following section) is also related and has had a significant effect on incidents during week 25.

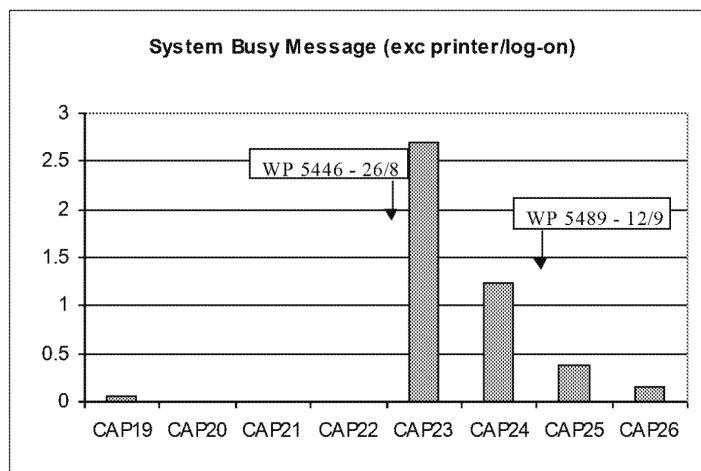
5.3.6 F1 Twice during log-on

This was a specific condition associated with incorrect handling of double keystroke “F1” during log-on (to navigate directly to “Serve Customer”) which could result in a system hang. A fix was issued for this (WP5406), which left a residual problem with certain OBCS book operations. A re-implemented fix was issued to cure this - see Section 5.3.12. A second fix to eliminate a small residual occurrence of the “F1” condition is under test at the time of writing and will be issued to the live estate during week commencing 13th September.



5.3.7 System Busy Message

This was introduced following discussion (via CR & Pathway CP2134) to provide visible indication to the user when the system is busy, particularly during longer, complex operations such as processing the cash account. This was distributed in WP 5407. The introduction of this message has itself resulted in a number of Help Desk calls, which have also been tracked and analysed. An improved version of the busy monitor routine was distributed (week commencing 6th September); this monitors only resource usage associated with the Riposte desktop and invoked applications. (The original utility monitored the total processor usage and could display the hourglass when background routines such as NT or Tivoli functions were consuming resource.)

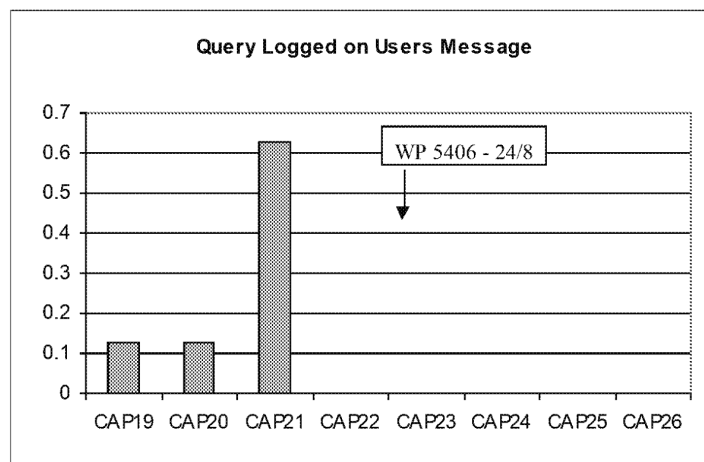


A minor problem has been detected with the operation of the Busy Monitor, in that after a few seconds it can partially obliterate a system message displayed on the screen if there is a printer problem when printing a Giro transaction. (This can occur when EPOSS is cycling awaiting the user response before continuing.) The touch panel is not disabled under these circumstances and the Help Desk will advise users to complete the response to the printer prompt, thereby allowing normal operation to continue without reboot. A “fix” to provide reworking of the Giro printer dialogue will be issued in due course. From CAP 24 specific problems associated with printer busy and log-on freezes have been separated into their own categories.

Note that if the clerk may legitimately return from a screen to a previous, having set off a print or transaction log query, and then undertake a second or third intensive transaction. A number of occurrences of the system busy condition are believed to result from such clerk initiated sequences. A block on the “previous” button is being investigated to preclude such behaviour.

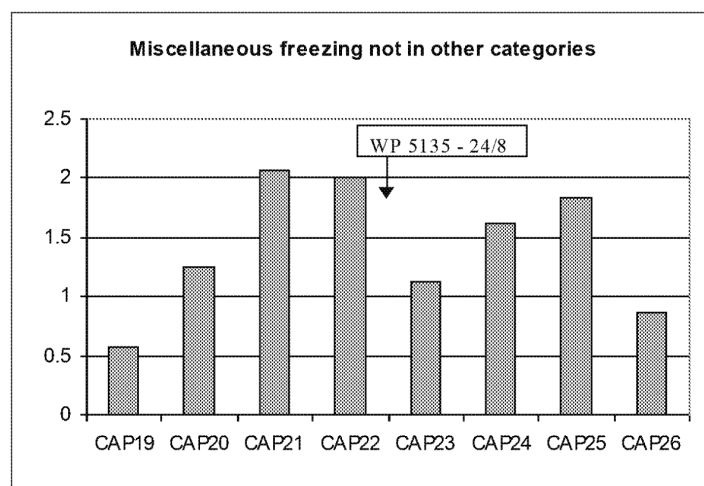
5.3.8 Query Logged-on Users Message

This was a specific problem that occurred during various operations when a user incorrectly received a message querying details of logged-on users. This was fixed in WP 5406, which has eliminated the problem.



5.3.9 Miscellaneous Freezing / Usage

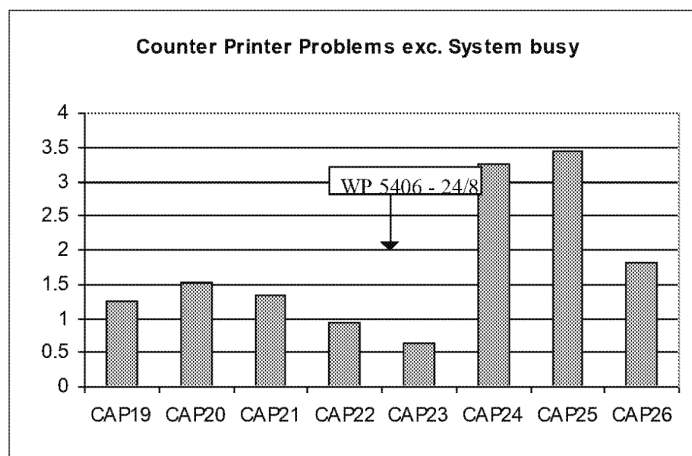
There have been a few occurrences of miscellaneous screen freezing during usage, mostly within Stock Unit declaration and balancing operations. A few reported occurrences were associated with virtual memory problems and are resolved with the fix identified in section 5.3.3. Several occurrences resulted from attempts to access message sequences beyond the 35-day archiving period and other occurrences are associated with multiple button pressing.



Diagnosis continues on these and appropriate fixes will be issued in due course.

5.3.10 Counter Printer problems

Two specific problems have been identified with counter printer operations. One was associated with the failure to print a second APS receipt, resulting in a subsequent system hang; this was fixed as part of WP 5406.

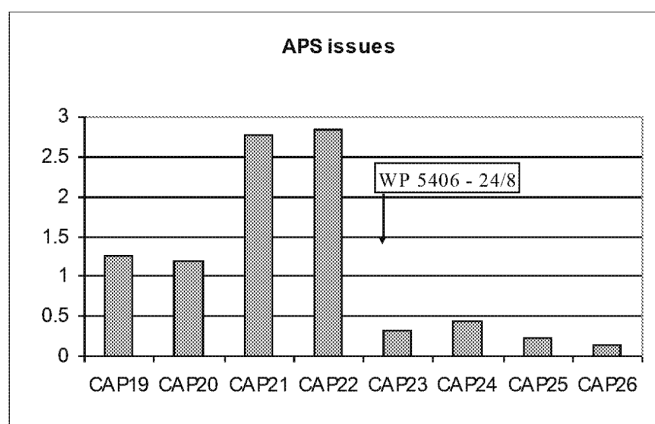


A second problem, associated with incorrect handling of printer failure conditions within the Giro transaction printing routine, has been identified and work is progressing on detailed diagnosis and resolution.

5.3.11 APS Problems

A number of APS application problems associated with receipt issue were identified (including the second receipt problem identified above).

In certain circumstances a failure in the APS receipting routines could leave buttons locked and a transaction on the stack. This was also fixed as part of WP 5406. A further fix was issued as part of the system freezing work (WP 5208) to specifically identify to the user the presence of APS recovery operations since this could give the appearance of a system freeze.

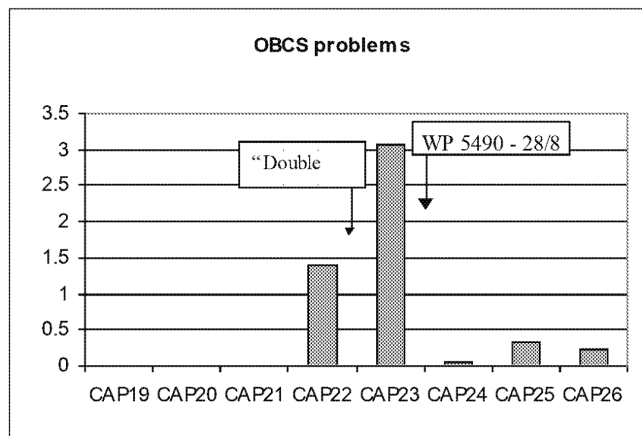


As can be seen, the overwhelming majority of APS related problems have now been eliminated.

5.3.12 OBCS Problems

The “Double F1” fix (see section 5.3.6) which resulted in problems with jumping screens during OBCS transactions (rather than normal screen navigation) introduced a further problem. This showed up on Help Desk call analysis as a significant problem

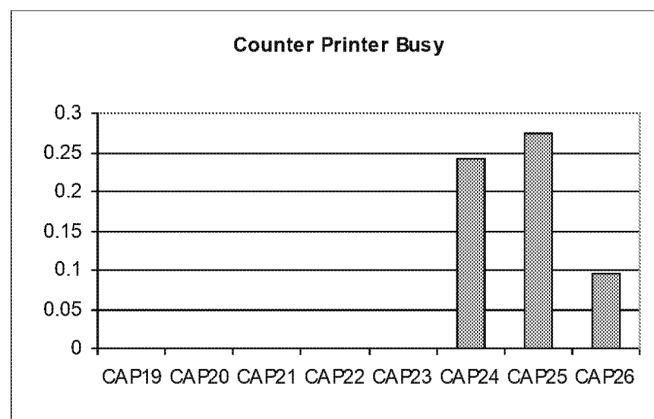
following the “Double F1” fix. The majority of the problems were addressed by WP5490; a fix relating to one further circumstance was included in WP 5405.



There have been no further recurrences of the problem.

5.3.13 Counter Printer Busy Problems

One particular class of problem shown up from the “system busy” indicator relates to a continuing counter printer busy condition returned to the application. These have now been classified as a particular incident type in their own right (from CAP 24).



A fix for the Riposte Peripheral Server is currently under test and is expected to be issued to the live estate during CAP 26.

5.4 Resolution of Incident Metrics

Pathway notes the POCL proposed metric of 1 system “lock-up” or “crash” (requiring reboot) per counter PC per annum.

The Pathway position is that this is an unrealistic and unwarranted requirement to be placed on the Pathway Solution.

5.4.1. Contractual Requirements

There is no contracted Service Level which Pathway is required to meet relating to lost time associated with OPS system stability incidents. (Lost time at the counter may contribute to an increase in the volume of fall-back transactions which may fall within the service reporting requirements of individual services – EPOSS, APS and OBCS.)

5.4.2. Comparison against Industry Norms

The POCL proposed level is unrealistically high when compared against normal operational usage of complex distributed systems based upon Windows NT. Typical industry norms of 1 event per month are reported. It is noted by both parties that a periodic planned “preventative” reboot, outside prime usage time, may be a sensible measure to help reduce the incidence of unplanned reboots.

5.4.3. Acceptance Position

AI 298 was raised against Requirement 536, on the basis of Live Trial usage experience.

The planned acceptance testing associated with this Requirement was fully completed with no outstanding issues. This comprised a combination of detailed technical test and a review of the technical specifications of the relevant equipment.

ICL Pathway has accepted that there have been some incidents at outlets, which have affected certain aspects of system operation. As detailed within Sections 5.2 and 5.3 there has already been a significant reduction in such incidents from the earlier levels in June and July when this AI was raised. Pathway set an internal target of one (authorised) reboot per month per counter and proposes that achievement of this level reduces the incident to a medium severity. The levels of lost time associated with the current incident rate fall well within this yardstick.

5.4.4. Resolution Proposal

POCL has indicated a desire to associate this incident with a further metric which would represent an “acceptable” level of operation with respect to the occurrence of system incidents prior to the full outlet rollout.

ICL Pathway will use all reasonable endeavours to reduce the incidence of interruptions to normal counter operations resulting from the use of the OPS platform and the Riposte desktop functions. Pathway has set a longer term (6 months) internal target of 1 Help Desk authorised reboot incident per counter per 4 months measured over the actual population of rolled out counters. Workarounds taking longer than

four minutes will counts as reboots. This represents a fourfold improvement beyond the initial target.

Monitoring during Oct/Nov

The success criteria in relation to this AI to be evaluated in November in relation to the continuation of national roll-out in January 2000 should have the following characteristics:

- The number of outlets installed within the live estate at 1st October, providing this number is at least 750, or if less than 750, the number at the end of the week during which 750 outlets is achieved.
- Incidents to be quantified in “units” where:
 - Help Desk authorised re-boots and Office Snapshot Print Previews to count as one unit;
 - Other workarounds to remove invalid no-entry signs to count as half a unit;
 - New workarounds to remove the need for re-boots (such workarounds to take less than 10% of the combined reboot and recovery time) to count as a half unit (those exceeding 10% to count as one unit).
- The rate of occurrence measured over the 4-week period to mid-November 1999 (CAP 31-34) should average no more than one unit per counter position per 3 months.

In addition, ICL Pathway will be entitled to continue the good business practice of planned reboots outside working hours not to exceed one per month per counter position.

Ongoing improvement and longer term

It is important to recognise that ICL Pathway is strongly motivated to reduce such incidents as they directly affect its own costs through staffing levels required at the Help Desk. The Pathway Help Desk model and projected staffing levels are consistent with this approach. For ICL Pathway this equates to a requirement to deal with up to 700 such calls per week as the outlet population increases over the next six months (and the incident rate falls). Clearly Pathway will be strongly motivated to seek any further possible reductions in incidents to reduce the corresponding call rate applied to a full estate.

For POCL the achievement of the ongoing target of 1 reboot per 4 months would result in a predicted loss of service of the order of 6.25 minutes per counter per month. For a typical outlet operational period of 42 hours per week this equates to a loss of service of < 0.06% per counter. In reality lost customer service time is likely to be significantly less than this since the above calculation:

- (i) makes no allowance for the possibility of directing customers to other counters during an incident

(ii) makes no allowance for that proportion of incidents which occur during back office processing and have no direct impact on customer service.

The incident analysis which has been jointly undertaken to date and the improved level of understanding of system usage within the live outlets both suggest that the target will be met within the projected 6 months. The most recent rate of authorised reboot incidents is approaching half the initial target level, leaving a further required halving to reach the final target. Pathway has undertaken analysis of several outstanding incidents and diagnosed the detail of the problem. Software fixes will be progressively released following regression testing which will see a further reduction on the current incident rates towards the target. Hence the progression towards the target is already substantially underpinned by known, diagnosed problems which are awaiting fix issue.

5.5 Improved Defect Removal for Future Releases

The level of testing conducted on the Pathway solution has by any standard been exceptionally high (over 100 dedicated testers, a staggering array of test environments, at a cost of 10s of £Millions). The large, complex and distributed nature of the system demands a sophisticated multi-layered approach to testing and integration. The strategy was developed and agreed in conjunction with the sponsor organisations at the outset, and was independently assessed during the treasury review as being 'leading edge'. It has been maintained in the light of experience of Release 1, and is currently again under review in respect of Release 2 (CSR). Of particular importance here is the experience of the Live Trial period, and the lessons that may be learned to further improve the Defect Removal rate for future releases, and so reduce the number of incidents encountered in the Live Estate.

5.5.1 PINICL Analysis

A review is underway of all the PinICL fixes applied across the whole of the Counter systems for the Live Trial Period. This period was split into 3, known as LT1, LT2, and CSR. Initial findings, measuring up to 31/08/99, indicate that a total of 133 PinICLs were involved. Of these, 2 were data related (including 1 on POCL Reference Data), 1 was build related, and 2 were purely administrative to introduce the decommissioning of BPS, leaving 128 software faults to be considered in all. (It may be of interest to note here that about 30 of these were for BPS, although this does not have a material bearing on the analysis.)

Of these 128 faults, just 50 were actually raised from activity in the Live Trial. The other 78 were all in fact raised during the course of testing. (Most of these were found long before the Live Trial in Pathway's System Test and Integration Test stages or in the MOT/E2E test stages immediately before the Live Trial. These were the subjects of agreed deferral via the KPR process, to allow for their controlled introduction

during the course of the Live Trial, to avoid destabilisation. A small number were raised after the KPR, as a result of Pathway's ongoing regression testing)

The records for these PinICLs have been analysed to determine the nature of the defects concerned. As a result they have been categorised accordingly, to help assess how best the Development Lifecycle, and in particular the testing and integration approach, may be revised to best detect such defects earlier, and so better protect the Live service. A large number of low level classifications were used, which can be summarised into the following high level categories:

1. Usability/Robustness:

MMI, Menus, Button locking, No-Entry signs, Double key strokes, Cosmetics, Enforcement of correct practice, Operational usability, Correct error handling, etc.

2. Stability/Performance:

Screen freezes, Printer hangs, Memory leaks, Blue screens, NT messages, Archiving anomalies, Function performance.

3. Application Logic:

Plain software bugs.

Initial findings indicate that the 128 fixes applied to during the Live Trial (78 faults found in Testing and 50 faults found in Live) can be categorised as follows:

Category	Testing Faults	Live Faults
Usability/Robustness	38	38
Stability/Performance	14	5
Application Logic	26	7

(To set these figures in context, overall testing has trapped several thousand defects, commensurate with the great size and complexity of this system.)

The following conclusions can be drawn:

- The overall approach has been extremely successful in reducing the exposure of the Live Estate to a very small residue of defects remaining in the system (which the industry recognises can never be entirely eliminated, although there is always room to improve).
- The incidence of defects discovered is demonstrably reducing over time, indicating a steady improvement in overall system stability.

- There is clear evidence that the majority of defects in the Usability/Robustness category have been trapped during testing, despite this being a notoriously difficult and expensive problem domain to address exhaustively through testing.
- Nonetheless, the majority of defects escaping capture during test are in the category Usability/Robustness, suggesting that there really is no substitute for genuine Live exposure to flush out these types of defect (as per generally accepted industry wisdom). It also suggests that this is the main area to target for future improvement, offering more scope. Further to this, the report from the EPOSS Defensive Test exercise was encouraging. It indicates that such short focussed test activities, concentrating on particular aspects of system usage, can have considerable success in removing defects both of the Usability/Robustness and Stability/Performance categories.

(The EPOSS Defensive Test exercise was an additional test initiative introduced by Pathway to satisfy test objectives relating to Usability/Robustness, which it was recognised had not been fully met by the Model Office exercise and the EPOSS Usability Trial.)

- Testing has eradicated all but a very few remaining Stability/Performance defects, albeit that these can impart a disproportionate effect on the Live Estate, further suggesting the importance of a Live Trial or equivalent period, where the impact on the business can be limited and controlled. The fact that a significant number of such defects were still being discovered in these late testing stages indicates that there is potential for improvement here also. It suggests that a more detailed analysis of the precise circumstances of these defects should be conducted to determine any common factors and to assess whether any benefit is to be had from specific testing actions earlier in the lifecycle.
- Testing has eradicated all but a very few remaining Application Logic defects. Little scope for improvement in this area, other than the perpetual goal of earlier discovery.

A further observation arising from the analysis would be that many of the PinICLs arising in the Live Trial system had in fact been the subjects of earlier PinICLs raised during the course of Testing. This is a common phenomenon. Typically it comes about because for certain classes of defect (particularly where it is related to timing, or multiple streams of activity in combination) the symptoms revealing the defect can not easily be reproduced until the underlying defect is properly understood. Because it cannot be reproduced the underlying defect can not be properly diagnosed. The faults are then often put down to some flaw in the test environment, or the wrong code versions being used, and the PinICL is closed 'unable to reproduce'. There is no easy remedy.

5.5.2 Implications for CSR+

A full review of the testing conducted for Release 2 (CSR) has already been conducted and a proposal document has been drafted “Revisions to the Testing & Integration Approach for Pathway Release CSR+”. Based on the findings above ICL Pathway and POCL will jointly consider the following proposals, and as agreed include them within a definitive version of that document. This review will take place by 30/10/99 and the definitive version of that document will be published by 24/11/99 and brought into effect from this date

- a) Analyse the precise circumstances of the defects in the Stability/Performance category. Identify any common factors.
- b) Analyse the precise circumstances of the defects in the Usability/Robustness category. Identify any common factors.
- c) From (a) and (b) above, establish any potential test points for existing testing stages, and, as reasonably necessary, extend their respective objectives/review-checklists accordingly. (Include Unit Test, System Test, and Conformance Test.)
- d) As reasonably necessary, extend Code Review checklists to cover the specifics from (a) & (b) above, with particular emphasis on the handling of exception conditions.
- e) Adopt the principles of the EPOSS Defensive Test exercise for wider application, and in particular to mount earlier exercises specifically targeting those attributes identified in (a) and (b) above. It is important that such test activities include the involvement of design-aware ‘experts’ having intimate knowledge of system areas subject to test and capable of targeting potential areas of weakness. Involvement of Users should also be considered to address usability related aspects.
- f) Work with POCL in determining appropriate and agreeable alternative(s) to the Live Trial for future releases, to allow each new product to be exposed to substantial Live use, but with limited business impact, for an appropriate period of time prior to general (national) release.

It should be noted that CSR+ has already benefited from the revisions included in the Testing Strategy and will, in due course, from the additions listed above. A lifecycle-wide review was also conducted earlier in the year, which resulted in a major reorganisation of the Systems and Programmes Directorates into the new Development Directorate. Amongst the initiatives introduced at that time were many which addressed lessons learned from earlier releases to improve the Design and Development stages for CSR+ and beyond. Of particular relevance here are:

- a) The formation of Delivery Units, focussing on particular Business and Infrastructure areas, made up of mixed discipline teams combining Design,

Development, Unit Test, and System Test, and so promoting higher product quality levels and greater lifecycle awareness. As each Delivery Unit spans all the platforms supporting the end to end business applications within their respective areas, this will also help to address the risks previously associated with cross-paradigm boundaries.

- b) The formation of the Technical Design Authority, providing central support to the Delivery Units, with particular responsibility to oversee the end to end design and ensure the overall technical integrity of the solution as a whole. One activity currently under way is the systematic retrospective reviews of the end to end Designs across the whole solution for CSR+. It should be noted here that these reviews are not restricted to targeted reviews of the changes at CSR+ but also encompass those areas of CSR+ inherited from CSR. (For example, it is planned to review the EPOSS, TPS and RDMC/RDDS systems on an end to end basis, not just the minor changes made in these areas at CSR+.) Pathway will also consider seeking the involvement in these reviews of other expert areas within ICL, external to Pathway, to bring an independent view for certain critical areas.
- c) General improvements in the areas of Design Review, Code review, Module Test Review and Link Test Review.
- d) Strengthening of Product Acceptance Test (on entry to Pathway) for 3rd Party developments.
- e) Closer working relationship between the Delivery Units and the Technical Integration area to promote rapid environment stabilisation.

Pathway already has in train a set of initiatives to improve the defensive measures deployed within the system in key risk areas. Much has already been done to introduce interlocks within the counter applications to preserve and protect the serial dependencies inherent in the VB runtime environment. This in large measure has eliminated the specific 'double entry' and parallel process 'hanging' issues underlying many of the Usability/Robustness and Stability/Performance problems. The future strategic goal here is the gradual introduction of more generic defensive measures, including a full cross-phase locking mechanism.

Following on from the recent investigations into residual memory problems under certain complex scenarios, Pathway has decided to deploy the BUSY.EXE toolset more widely in testing for CSR+, using it in a pre-emptive fashion rather than purely as a debug tool.

ICL Pathway believes that introducing further changes to the Design and Development stages (other than ensuring that good practice is maintained) would result in only a marginal reduction of the defects in question. The majority of the CSR+ functionality has now entered Link Test or System Test, so it would be sensible at this stage to focus in these and later stages of the lifecycle.

**ICL
Pathway**

**Acceptance Incident 298 – Resolution
Plan**

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