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PROCESSING: ISSUES IN CENTRAL BANKS

THE RESERVE BANK OF AUSTRALIA'S EXPERIENCE

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POLYMER NOTE PROCESSING

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THE RESERVE BANK OF AUSTRALIA'S EXPERIENCE

The Reserve Bank of Australia has over ten years experience with the handling and processing of polymer bank notes. This experience commenced with the issue of Australia's first polymer note in January 1988 - a commemorative $10 note. A new series of polymer notes was then released commencing with a $5 note in June 1992. By May 1996 the new polymer notes were well on the way to replacing the existing paper series with the result that today few paper notes are seen in circulation or returned to the Reserve Bank for processing/destruction.

The Reserve Bank of Australia issues new and reissue notes into circulation through its branches located in five of Australia's eight capital cities. Cash in transit companies (known in Australia as armoured car companies [ACCs]) assist with this process by operating Note Pools which distribute notes to the financial and business communities. Unfit notes and a quantity of fit notes are returned to the Reserve Bank to be checked for authenticity and cleanliness, with the unfit notes being destroyed during processing.

The Reserve Bank uses Currency Verification Counting and Sorting (CVCS) systems for the processing of notes returned to it. The CVCS systems were manufactured by Recognition Equipment Incorporated (REI), Dallas, USA and were purchased during the period 1981 to 1986. The Bank has twenty-two CVCS systems, although following changes over the last year or so, only seventeen of these are now in operation.

The CVCS system was initially designed for the processing of paper notes and served the Bank well in this role. The 1970s based technology was, however, restricted in its ability to provide much more than basic mechanical fitness (holes, tears, tape, etc) detection and soil fitness was used as the main discriminator in the reissue/destruction process.

Early in 1990 the Bank took the decision to substantially upgrade its CVCS systems in order to achieve:

- better mechanical fitness detection as this was expected to be the major criteria for sorting polymer notes; and

- an open architecture operating system.

The upgrade was undertaken by Currency Systems International (CSI), a new player at the time in the high speed note processing equipment field.

The upgrade decision was taken with polymer note processing in mind but would most probably been taken even if the Bank had not gone down the polymer track. As mentioned earlier, mechanical and soil fitness detection on the Bank's existing CVCS systems was relatively crude and there was a need to improve such detection. REI had completed a similar upgrade for the Federal Reserve and Bank of Canada for their CVCS systems.

Upgraded CVCS systems provided the Bank with more efficient processing of paper notes initially. These efficiencies were later applied to the processing of polymer notes. With upgraded CVCS systems the Bank was able to achieve:

- much better detection of unfit notes. The identification of mechanical defects (holes, tears, tape, missing corners, etc) was much easier and more precise. The Bank was able to determine whether or not to destroy notes with particular sized mechanical defects. Soil fitness was also much more precise with each note being examined for soiling over a much larger portion of the surface of the note (previously soil fitness was determined by the discolouration of the white area of each note) and then being sorted into one of sixteen fitness categories. Again the Bank had the ability to destroy or reissue notes above or below any one of the sixteen levels. As a result of installing the new fitness detectors the Bank was able to introduce a consistent note standard Australia-wide;

- improved denomination/authentication. The redesigned denomination detector provided improved authentication of notes through the examination of a larger surface of each note. Magnetics detection was also improved;

- interface of third party detectors. Prior to the upgrade limitations of the CVCS systems' 6800 micro processor meant that interface of third party detectors was very difficult if not impossible. With the upgrade the Bank was able to interface third party detectors via the improved processing capability of the upgrade's VME based processors. At the time Note Printing Australia (NPA) was well advanced with the development of its High Level Authentication System (HLAS) for authenticating, and if desired, denominating notes;

- enhanced management information collection. With the upgrade a host of additional information was available on numerous aspects of note processing.

The upgrade provided considerable gains for the Bank in its processing of paper notes. Importantly, it placed the Bank in an excellent position for the processing of polymer notes as they were progressively introduced over the period June 1992 to May 1996. Polymer notes were not expected to soil like paper notes. More reliance was, therefore, placed on the detection of mechanical defects generated while notes were in circulation. While the polymer substrate was found to be extremely tough, tear propagation is relatively easy once the outer perimeter of the note has been damaged. The detection of such defects, therefore, became the prime discriminator for the identification of unfit polymer notes. NPA had completed development of the HLAS and this was able to be incorporated into CVCS systems thus providing advanced authentication and denomination of the Bank's new polymer series.

With the introduction of the new polymer note series over a four year period it was necessary for CVCS system to be able to process both paper and polymer notes. The CVCS system was able to comfortably achieve this. Because of the sizing of new notes (much smaller than the paper series) it was, however, necessary for polymer notes to be processed separately to paper notes but this created no problem for the upgraded CVCS systems.

Additional modification/changes required for the processing of polymer notes included;

- the development of new denominational masks but these would also have been required for new designs of paper notes. With upgraded CVCS systems this, however, was a simple task;

- the replacement of shredders with granulators. It was found that the existing shredder operation generated too much heat and resulted in the thin strips of shredded polymer notes produced during shredding becoming heated and attaching themselves to the shredder mechanism. Initially, the Bank purchased from REI a number of granulators manufactured by the US company Security Engineered Machinery. These proved very efficient in the destruction of unfit polymer and paper notes. The Bank subsequently purchased additional granulators from an Australia company - Mecal Australia;

- more precise humidity control. By their nature, polymer notes can create static electricity in the transportation and stacking of notes. The Bank found, however, that provided relative humidity in the CVCS room was maintained at the upper end of the band recommended by REI as the acceptable environment for operation of CVCS systems (around 60/70%) notes transported and stacked nearly as well as paper notes. Some guides were also manufactured and installed in the CVCS stackers/strappers to assist with stacking of polymer notes - this was related to the much smaller size of the new notes;

- some minor system adjustments, ie:

    - a reduction in air supply to the CVCS feeder was necessary to prevent the lighter polymer notes lifting in the feeder and consequently not feeding properly into the system;

    - the skew bar in the feeder also needed slight modification;

    - as mentioned above, some guides were installed in the stacker/strappers to assist with stacking of notes;

    - a softer rubber sleeve was required on the gripping mechanism of the CVCS strappers to compensate for the firmer “feel” of each section of notes;

    - the CVCS system uses heat sealing of notes straps rather than ultrasonics. The voltage of the strapper heat sealing mechanism and the shape of the sealer “anvil” needed adjustment. With paper notes the voltage level at the sealer had not been an issue, however, because of the nature of the polymer substrate which will melt if exposed to extreme heat, it was necessary to reduce the sealer’s voltage to prevent it melting the top two notes of banded sections and “welding” them together. To assist in this process it was also necessary to reshape the “anvil” which incorporated the sealing mechanism;

- manual air separation of notes in the CVCS feeder. Operators found that by blowing air over notes in the CVCS feeder the notes separated much easier when feeding into the CVCS system.

Initially throughput rates for polymer notes processing were down around 25% on rates for paper note processing. A review of processing found, however, that once an initial operator reaction to the processing of polymer notes as opposed to paper notes was identified and corrected, throughput rates improved with the result that higher throughput rates have been achieved with polymer notes.

Over time, around four times the life of the paper notes, the $5 and then the $10 polymer notes started to show signs of ink wear, particularly along fold/crease lines. The Bank embarked on a project to develop a fitness detector for polymer notes based on examination of ink wear. The maintenance provider for CVCS, the Australian company TechComm, was engaged to develop and manufacture the detector. The Polymer Note Fitness detector subsequently developed operates along the following lines;

- the area around the centre of the note is rear lit;
- an image of the area is captured by a high speed camera;
- the captured image is compared to a stored mask of a new note;
- the note is then classified into one of seven levels of fitness and either destroyed or reissued.

At present, the Bank only uses the Polymer Note Fitness detector for detection of unfit polymer $10 notes as this denomination is the only one at this stage to show sufficient wear to enable development of a suitable mask. (The Bank has issued a recoloured $5 note since the issue of the first polymer $5 note in 1992. Original $5 polymer notes have, in the main, been withdrawn from circulation.)

Three other minor processing issues are worth noting. Firstly, on occasions notes with (unrepaired) closed tears can tear further during processing. This can result in a note with a missing portion being reissued by the Bank. We are presently exploring with CSI and detector manufacturers ways of improving detection of closed tears in order to eliminate this slight problem. Secondly, if there are obstructions along the transport path, polymer notes with corner folds are more likely than paper notes to catch on such obstructions. Thirdly, as with paper notes, unfit polymer notes are more difficult to process than fit notes.

Summary

On balance, the transition to polymer note processing for the Reserve Bank of Australia has been comparatively easy. Some changes to work practices have been necessary as have some adjustments to processing equipment, although both have been relatively minor. CVCS processing efficiency for polymer notes is on par with paper notes processing and at times greater throughput has been achieved with polymer notes.