HONG KONG'S REAL TIME GROSS SETTLEMENT SYSTEM

To meet international standards and minimize settlement risks, Hong Kong's large-value interbank payment system cut over to a Real Time Gross Settlement (RTGS) system on 9 December 1996. This paper explains the key features of the new RTGS system and highlights the important issues relating to its implementation.

Background

In order for Hong Kong to maintain its status as an international financial centre, the Hong Kong Monetary Authority (HKMA) has been working closely with the banking industry to ensure that Hong Kong has an efficient and robust payment system, which is an essential market infrastructure. The new RTGS system, which cut over on 9 December, was the result of untiring effort between the HKMA and the banking industry in the past three years.

In January 1994, the HKMA's Working Party on Payment and Settlement System recommended that Hong Kong should move to RTGS as soon as possible. Since the issue was of strategic importance and involved the whole banking community, a Committee on Payment System (CPS), chaired by the Chief Executive of HKMA and attended by representatives from the leading banks in Hong Kong, was set up on 31 May 1994 to provide policy steer on the implementation of RTGS in Hong Kong. At the same time, the Hong Kong Association of Banks (HKAB) commissioned in June 1994 an RTGS Feasibility Study based on the recommendations of the Working Party. The CPS has met six times since May 1994 and has provided advice on the design of the RTGS system and on business issues particularly those relating to intraday liquidity management. The core features of the RTGS system are as follows:

(a) compliance with international standards;

(b) final settlement across the books of the HKMA;

(c) a single tier system in which all licensed banks maintain settlement accounts with the HKMA;

(d) while no daylight overdraft is allowed, banks can obtain intraday liquidity through intraday repurchase (repo) with the HKMA, using mainly government paper, i.e. Exchange Fund Bills/Notes; and

(e) allowance for domestic and international linkages to facilitate real time delivery versus payment (DvP) and real time payment versus payment (PvP).

Design of the new RTGS system

In accordance with the CPS' advice, the RTGS system has adopted a Y-shaped topology (Chart I) with all licensed banks having direct access to the system. The Y-shaped topology of information and payment flow means that the system will be simple and direct. While a bank will input the full details of its payment instructions, including customer information, to a central transaction processor (Interbank Fund Transfer Processor), the instruction will be "stripped" so that only the settlement instruction, i.e. information on the amount, the paying bank and the receiving bank, will be passed onto the Settlement Account Processor and be known by the HKMA.

Chart I
Design of Hong Kong's RTGS System
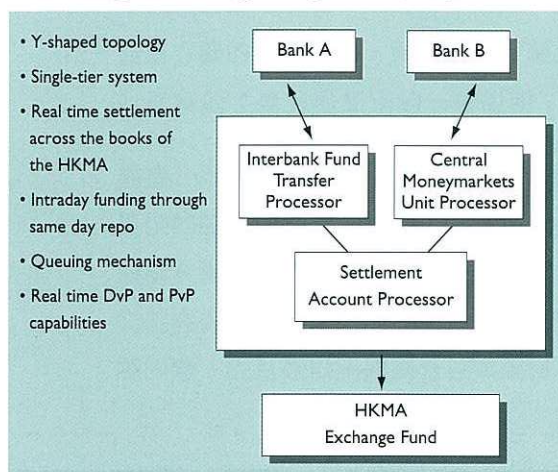
When a payment has been settled across the books of the HKMA, it can be regarded as final and irrevocable. The Settlement Accounts maintained by the banks with the HKMA will not be allowed by the HKMA to go into overdraft unless in very exceptional circumstances. Hence, banks without sufficient credit balance or securities for intraday repo to effect outgoing payment instructions will have their instructions queued in the system. The queuing mechanism allows the banks to manage their own queues of payment instructions through cancellation, resequencing and amendments.

Under an RTGS system, it is necessary to address how intraday liquidity can be provided to the banks in order to reduce the chance of gridlock being developed since every payment has to be settled on an individual and gross basis. A related issue is whether the liquidity should be unsecured or collateralised. In Hong Kong's RTGS system, there is a seamless interface between the funds transfer system (IFTP) and the book-entry debt securities clearing system (the Central Moneymarkets Unit (CMU) which is operated by the HKMA). Banks can obtain interest-free intraday liquidity through intraday repo using Exchange Fund Bills/Notes. The intraday repo transactions are fully automated. If a bank does not have sufficient balance in its settlement account to effect an outgoing payment but has sufficient eligible securities in its intraday repo account, the system will automatically trigger an intraday repo transaction to generate the required amount of credit balance to cover the shortfall. A bank with excess liquidity in its Settlement Account may reverse the repo transaction any time. In any case, the intraday repo will be reversed before the close of the business day.

Operator of the RTGS system

The operator of the new payment system is the Hong Kong Interbank Clearing Limited (HKICL), a company jointly owned by the HKMA and the HKAB. The HKICL was set up in May 1995 to take over in phases the clearing functions provided by the former Management Bank of the Clearing House, i.e. The Hongkong & Shanghai Banking Corporation Limited (HSBC). HSBC had performed the Clearing House functions on behalf of HKAB under a contract with the HKAB prior to December 1996.

HKMA's roles under the new RTGS system

Under the new RTGS system, the HKMA performs the following roles:

(a) settlement institution: under the new RTGS system, HKMA has taken over the Management Bank's role as the settlement institution. Instead of having the previous two-tier structure which had ten Settlement Banks, one of which is HSBC, and over 170 Sub-settlement Banks settling across the books of their respective Settlement Banks, all licensed banks now maintain Settlement Accounts directly with the HKMA. Settlement is across the books of the HKMA;

(b) operator of CMU: the HKMA continues to operate the CMU system, which is now fully integrated with the funds transfer system and possesses real time DvP capability;

(c) provider of intraday liquidity and lender of the last resort: in line with its role as the lender of last resort, HKMA monitors the payment flows very closely and offers liquidity if and when appropriate to prevent a gridlock from happening; and

(d) overseer of the payment system: in performing the above functions, the HKMA is playing a direct role in overseeing the operation and development of Hong Kong's payment system.

Implementation of the RTGS project

It took two years (from January 1995 to December 1996) to implement the RTGS Project. Chart II below shows the major milestones of the projects.

System development

As in any major system development projects, we have encountered a number of problems and issues. For example, we had had serious problems with the stability of the gateway connecting the Personal Computer-based member bank terminals with the host system. We offer two technological

Chart II
RTGS Project
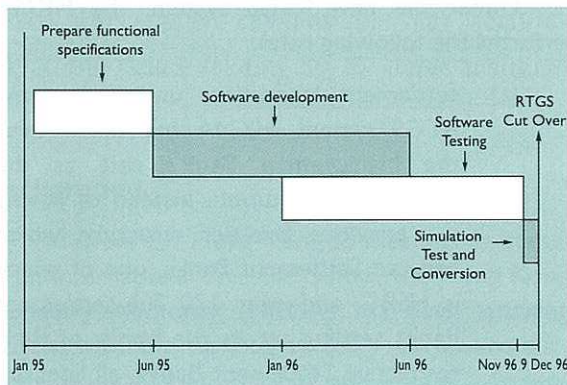
platforms for member bank terminals (MBTs): a mini-computer (AS400) or a Personal Computer (PC). About half of the banks use AS400 and the other half use PC. It had taken the software developer a long time to diagnose the problems and deliver the correct fixes. At the same time, more than one thousand system investigation requests (SIRs) had been identified by the HKMA's testing team during the User Acceptance Tests of the Settlement Account Processor and Central Moneymarkets Unit Processor software. The problems were rectified by the software vendors after intensive investigation and re-testing. Considerable effort and time have also been spent to set up the computer environments for testing and production.

The series of simulation tests held from 16 November to 4 December 1996 have proved to be very useful in providing opportunities for banks to gain first hand experience in operating the new system and for HKICL to fine tune the software and hardware of the system and work procedures prior to the cut over to RTGS on 9 December.

Banks' readiness

Prior to the simulation tests, HKMA convened a series of briefing and training sessions to help banks familiarize with the features and operational procedures of the RTGS system. Hands-on training for banks on detailed operating procedures provided by the HKMA and the HKICL began in September 1996. In October, the HKMA conducted a Workshop on Liquidity Management under RTGS which was well attended by over 300 bank

treasurers from more than 150 banks. The workshop provided a useful forum for bank treasurers to exchange views with top payment system experts from the U.K., Switzerland and the World Bank on liquidity management issues. The Chief Executive of the HKMA issued a letter to banks on 25 October to remind them of the need to ensure that their computer systems, operating procedures and staff are ready when the RTGS cut over on 9 December. To follow up the issues raised at the Workshop on Liquidity Management, the HKMA formed a working group with representatives from the major banks and HKAB to consider further measures to improve liquidity management under the RTGS system.

Liquidity management measures under RTGS

Notwithstanding the availability of intraday repo facility, some banks were concerned about other banks holding on to liquidity until late in the afternoon and the risk of technical default of the time-critical bulk clearing payments. Having consulted the CPS, the HKMA introduced two additional measures to address these concerns.

Guideline on CHATS throughput

The guideline is designed to encourage banks to make payments in a timely and an orderly manner throughout the day. A bank is required to release and settle payments whose aggregate value is not less than 50% by 12:00 noon and 75% by 2:30 p.m. of the value of its total CHATS payments that day.

As banks may need some time to gain practical experience to manage payment flows efficiently, lower throughput levels of 35% by 12:00 noon and 65% by 2:30 p.m. have been adopted. However, banks are asked to move towards the higher target throughput levels as soon as practicable and in any case not later than 31 March 1997.

It is not envisaged that there is a need to introduce formal sanctions for breaches of the throughput guideline, as we expect that the banks will make their best effort to comply. However, the HKMA will monitor closely banks' compliance with the throughput targets and review the need for formal sanctions in the light of actual experience.

Liquidity Adjustment Window

The Liquidity Adjustment Window (LAW) is a contingent liquidity facility which allows banks to obtain intraday liquidity from the HKMA through repo of Liquidity Adjustment Facility (LAF) eligible securities other than Exchange Fund Bills and Notes. (LAF is Hong Kong's version of discount window through which banks can borrow overnight money from HKMA). LAW is devised for the purpose of helping banks to settle the time-critical bulk clearing obligations, i.e. net settlement for stock market transactions, low-value bulk electronic payment items and cheques. The features of LAW are as follows:

(a) opening time: it opens for 30 minutes prior to the final settlement time for each bulk clearing run;

(b) eligible securities: LAF eligible securities issued by private sector issuers; and

(c) interest rate: to be determined by the HKMA from time to time. The HKMA's present intention is to charge one full day's interest at the LAF Offer Rate (6%) on the amount of cash borrowed once an intraday repo under LAW has been triggered.

Increase the issue of Exchange Fund Bills

In October 1996, banks in Hong Kong were holding $54 bn of Exchange Fund Bills and Notes. This amount, compared with the average daily turnover of the Clearing House of $300 bn, was considered to be adequate for meeting the overall liquidity requirement of the interbank payment system under RTGS. However, uneven distribution of the Bills and Notes was an issue as some banks wished to play safe by holding a larger amount of Exchange Fund paper than was required by their payment obligations in the initial stage of RTGS implementation and many foreign banks intended to acquire Exchange Fund paper just before 9 December to minimize the carrying cost of holding the low yield paper.

This resulted in an upsurge in demand for Exchange Fund Bills since early November as evidenced by the widening spreads between the yields of Exchange Fund Bills and the interbank interest rates. To meet the demand of the banks and to avoid the interest spreads from widening further, the HKMA increased the supply of short-term Bills by:

(a) increasing the issue and reserve amounts of 3-month and 6-month Exchange Fund Bills by a total of $13.5 bn; and

(b) issuing 3 tap-issues of 28-day Exchange Fund Bills of a total issue size of $20 bn.

In announcing these tap issues in mid November, the HKMA indicated that they may be the rolled over to ensure that the extra liquidity is maintained in the system in the initial weeks of RTGS implementation.

Performance of the new RTGS/CMU system

Following extensive simulation tests, Hong Kong's large-value interbank payment system successfully cut over to RTGS on 9 December. The system has been operating smoothly. No major problems have been encountered for CHATS payments, the settlement of bulk clearing items and CMU transactions. The banks also generally perform well in liquidity management.

System performance

The performance of the RTGS system has been stable and satisfactory. The computer system processed an average daily throughput of 12,413 CHATS transactions (involving $317 bn), 246 CMU secondary market transactions (involving $13 bn) and 499 intraday repo transactions (involving $26 bn) on weekdays (see Table 1). The value of CHATS payments processed on Saturdays was relatively small at an average of below $8 bn per day. The system has no difficulty in handling the current volume of transactions. The response time for fund / securities transfers and enquiries, averaged at about 2 to $2^1/_2$ seconds, is satisfactory. There have been several minor incidents of telecommunication line failure and one incident of front-end terminal failure but none has resulted in any significant disruption to the clearing time-table.

The processing of the three daily bulk clearing runs for the net settlement for stock market transactions, low-value bulk electronic payment items and paper cheques has also been smooth. Initially we needed to remind some banks to transfer Exchange Fund paper into their intraday

Table 1

RTGS Summary Report
(9-31 December 1996)

Average*

Turnover	Number	Value ($bn)
CHATS payments completed	12,413	317
CMU secondary market deals	246	13
Intraday repo (EF Bills & Notes)	499	26
Intraday repo (LAW)**	0	0

Response time	Average for the day (sec.)
IFT Transaction Average Response Time	2.0
CMT Transaction Average Response Time	2.6

Bulk Clearing	No. of runs	Processing time (min.)
CCASS	2	6
EPSCO	2	5
CLG	3	11
CMU End-of-day	3	38

CHATS Throughput	Value ($bn)	% of total
By Noon	92	29
By 2:30 p.m.	166	52
Total	317	100

*   Average for all weekdays between 9 and 31 December, excluding Saturdays and public holidays (25 and 26 December).
**   Intraday repo (LAW) was triggered three times during the period under review:
   i)   once on 12 December involving $20mn.
   ii)   twice on 24 December involving $7mn and $3mn respectively.

repo accounts to effect intraday repo to settle their bulk clearing payments. Banks are now familiar with these procedures. All, except two, bulk clearing runs in the first eighteen days of implementation were completed well within the specified 30-minute clearing period. On average, the processing time is 11 minutes for the clearing of cheques, 6 minutes for stock market transactions, and 5 minutes for low-value bulk electronic payment items.

The HKMA, together with HKAB, will continue to work closely with the HKICL and the software vendor (i.e. HSBC) to enhance the system to make it more user friendly and efficient. Specifically, we are pursuing the following improvement measures:

(a) further fine-tuning of the system to shorten the response time in general;

(b) the software vendor has been asked to develop an alternative function for banks to enquire the current balance in their Settlement Accounts in a more timely manner. The software will be rolled out as soon as it has been tested;

(c) HKICL is discussing with those banks which have a higher tendency of being logged off to see what can be done to increase the robustness of their communication links with the host computer; and

(d) HKICL is considering the merit, cost and timing of enhancing the hardware of the host computer system.

Intraday liquidity management

The RTGS system has increased significantly the transparency of the liquidity management process. This is generally welcomed by the bank treasurers as it enables them to manage their funding more efficiently through:

(a) making real-time enquiry of the balance in their Settlement Accounts and the securities in their Intraday Repo Accounts which may be used to obtain liquidity for CHATS payments;

(b) receiving advance notice of the net amounts they will need to pay (or

receive) for each of the three bulk clearing runs early in the morning; and

(c) receiving advance notice of the aggregate value of incoming payments from other banks after 5:00 p.m. which allows the banks to assess precisely the amount of funds they need to borrow from LAF or to place with LAF.

Intraday repo

The banks have made good use of their Exchange Fund paper to obtain interest free intraday liquidity through conducting intraday repo transactions with the HKMA for settlement of interbank payments. Out of the 181 banks, 146 banks have made use of the facility at least once during this period. An average of 499 intraday repo transactions, involving $26 bn, were done daily to facilitate payment flows. This represents about 33% of the $78 bn Exchange Fund paper currently held by banks. The Liquidity Adjustment Window, which was designed as a fall-back intraday liquidity facility, has been triggered only thrice involving a total of $30 mn. This shows that the banks are generally managing their intraday liquidity reasonably well.

28-day Exchange Fund Bills

Most banks continued to adopt a cautious approach by holding substantial amounts of Exchange Fund Bills. The demand for Bills remained strong in the initial period of RTGS implementation and only started to weaken in January 1997. As a result, the spreads between the yields of Exchange Fund Bills and the interbank interest rates (HIBOR) on 20 January were narrower than those on 6 December prior to the implementation of RTGS:

	6 December (b.p.)	20 January (b.p.)
28-day Bills	116	63
91-day Bills	94	81
182-day Bills	80	76

As the yield of the 28-day Exchange Fund Bills is still substantially lower than HIBOR of corresponding maturity reflecting continuing demand, the first two tap issues of $5 bn each have been rolled over once and were tendered on 24 and 31 December 1996. In view of the low over-subscription rates of both issues at the second

tender (0.36 time and 0.14 time respectively), the HKMA has decided to reduce the issue size of the second tender of the third tap issue from $10 bn to $5 bn. The second tender of the third tap issue ($5 bn) took place on 2 January 1997 and was under-subscribed by $1,750 mn. HKMA will continue to monitor closely the spread between the yield of the 28-day Bills and HIBOR before deciding whether there is a need to roll over the three tap issues further.

Guideline on CHATS throughput

In accordance with the Guideline, banks are asked to settle not less than 35% of the total value of their daily CHATS payments by 12:00 noon and 65% by 2:30 p.m. initially, and increase the levels to 50% and 75% respectively not later than 31 March 1997. Up to 31 December, the average throughput of all banks was 29% by 12:00 noon and 52% by 2:30 p.m., which falls short of the initial throughput targets. A more detailed breakdown of the throughput levels on each day is at Table 2.

Notwithstanding that the banks were generally not yet able to meet the initial throughput targets, we have detected no signs of banks hoarding liquidity until late in the afternoon. The system has also not experienced any gridlock so far. We expect that the banks should be able to perform better with more practical experience to manage payment flows effectively. The HKMA will continue to monitor closely banks' compliance with the CHATS throughput targets and will discuss with the banks individually if necessary.

IPOs

Some banks have suggested that the receiving bank of an IPO exercise should make use of cheques to effect its lending to other banks made in anticipation of IPO funds drawn on those other banks returning to the receiving bank. This way of synchronizing outgoing and incoming funds by the receiving bank would obviate the need for the receiving bank to arrange adequate funding for its lending to the other banks for the IPO which would have to be made available through CHATS under RTGS before the bulk clearing of cheques. While we continue to encourage banks to use CHATS under RTGS to settle large interbank payments to minimise settlement risks, it is recognized that the use of cheques in this way may be the only practical arrangement for a receiving bank if IPOs involving very large amounts were to be accommodated. However this arrangement is inefficient and runs counter to the whole purpose of introducing RTGS. The HKMA considers therefore that market participants should examine and promote the use of alternative means for organising IPOs that involve less disruptive funding arrangements. The HKMA will be closely monitoring developments on this matter.

Concluding remark

After the successful launch of the RTGS system, Hong Kong's payment system has entered a new era. In this coming year, the HKMA will:

(a) enhance and fine tune the system to make it more robust and user friendly;

(b) continue to monitor the performance of the system and the banks' payment behaviour, in particular their compliance with the CHATS throughput guidelines; and

(c) continue our discussions with other financial centres to explore the possibility of establishing payment versus payment links. ✤

– Prepared by the Monetary Policy & Markets Department

Table 2

CHATS Throughput

	% of total	
	By Noon	By 2:30 p.m.
9 Dec (Mon)	37	64
10 Dec (Tue)	38	64
11 Dec (Wed)	34	48
12 Dec (Thur)	29	55
13 Dec (Fri)	28	52
16 Dec (Mon)	25	52
17 Dec (Tue)	33	55
18 Dec (Wed)	29	48
19 Dec (Thur)	31	55
20 Dec (Fri)	19	45
23 Dec (Mon)	26	46
24 Dec (Tue)	25	51
27 Dec (Fri)	27	48
30 Dec (Mon)	32	52
31 Dec (Tue)	25	52