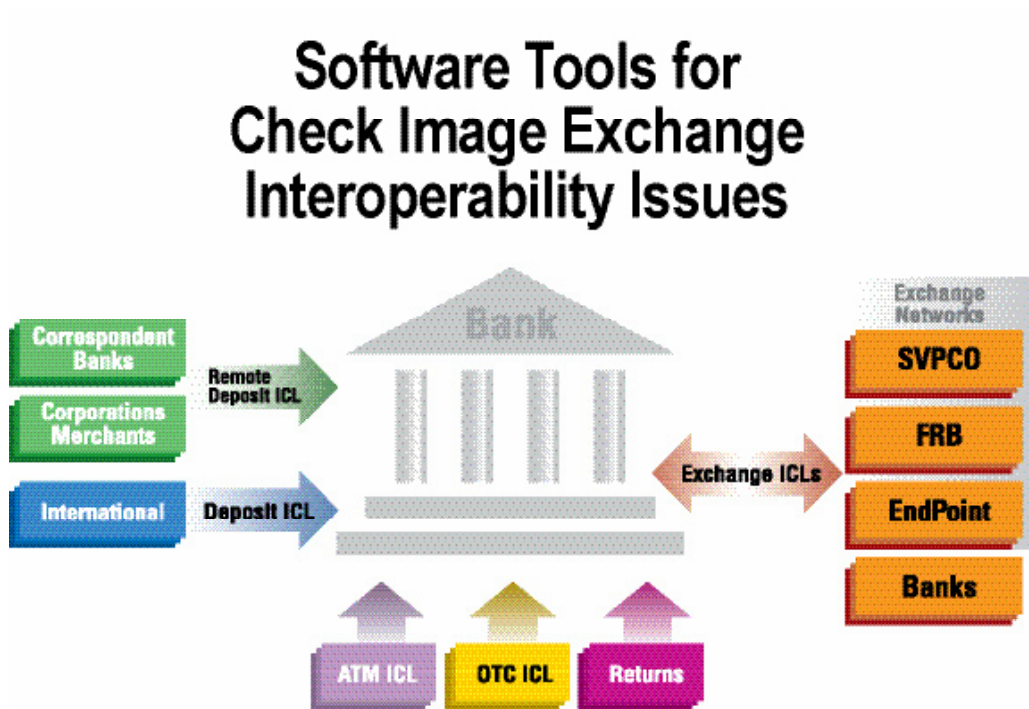




Working with X9.37 Image Cash Letters (ICLs)

By Ray Higgins and Bill Lange



And Data Integrity Issues

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Executive Summary

This white paper provides valuable information on how to reduce implementation costs, save time, and minimize ongoing maintenance efforts when working with or implementing a system that will process Image Cash Letters (ICLs), also known as X9.37 files.

This applies to:

- Financial institutions (banks, credit unions, FRB)
- Check Image Exchange Network providers
- Corporations, retailers, and other merchants who deposit checks and/or need to reconcile check payments
- LockBox Service providers
- IT departments that will implement or manage check clearing systems
- System implementers of check payment clearing systems (capture, clearing, & exchange)

ICLs are used to transport check transaction data, including check images, between organizations and systems for the purposes of clearing the check payments electronically. ICLs have become the preferred vehicle for transporting electronic check payment transactions between organizations and systems.

Because ICL standards, formats, and supporting technology continue to evolve, it is no easy task to implement a system that uses ICLs.

The ICLs transport the image and MICR data captured from paper check transactions. The accuracy and usability of these data elements is essential to the clearing and processing of the transaction. This white paper explains data integrity issues with these important data elements.

Included is advice on how to implement your system so that it ensures interoperability with multiple systems and maintains data integrity throughout the process.

ICL transactions have a direct impact on operational costs and potential losses for investment income through reductions in float.

There are also the costs associated with increased risk exposures, and costs associated with loss of customer satisfaction.

Many large and small organizations have applied technology from All My Papers (AMP) for solving problems with their specific ICL systems and products. They all enjoy the competitive advantages provided by lower development costs, rapid implementation time, and realizing an efficient well behaved system.

All My Papers is the developer and distributor of software development toolkits that provide the ability to create, view, edit, format, sort, merge, and process ICL X9.37 files. All My Papers Software Development Toolkits (SDK) and applications process, extract data from and print check images. Using these tools will isolate the ICL system implementer from the intricacies of ICL processing.

Executive Summary

All My Papers offers tools for all the possible ICL interface processing points that a financial institution might have, including:

- Building ICL files from captured data
- Processing ICL files sent/received through exchange networks
- Processing ICL files sent/received directly via other banks
- Processing received ICL files from Remote Deposit customers (can include corporate, correspondent banks, and international deposits)
- Printing IRDs from ICL files
- Internal processing of ICL data within the financial institution

Fast and accurate technology from All My Papers is packed into our software development kits and applications. Our products for ICL processing include:

AmpLIB MICR OCR SDK to perform MICR OCR and MICR Verify operations required to autocorrect rejects and misreads in MICR information captured on check scanners and received in ICL files. Image repair functionality will reduce file sizes and increase CAR/LAR read rates.

AX9LIB SDK to create, format, and edit Image Cash Letter (ICL) files in X9.37 and ANS X9.100-180 format to solve interoperability file and data integrity problems associated with check image exchange.

X9 VIEWER application to allow users to view, analyze, and edit ICL files to identify and resolve interoperability and data integrity issues.

X9 QUALIFIER application quickly verifies the quality, contents, and format of X9.37 files.

IRDLIB SDK -- IRD Printing to provide fast, accurate, and reliable printing of valid Image Replacement Documents.

AmpSQL database product to enable import/export/research of ICL data with duplicate detection capability.

In the final section of this white paper, we describe five problems faced by real customers and how they applied technology from All My Papers to overcome these problems.

1. Case Study: Remote Image Replacement Document (IRD) Printing
2. Case Study: Supporting Proprietary Bank ICL Format
3. Case Study: Viewing, Conformance Testing, & Editing ICLs
4. Case Study: ICL Return Processing
5. Case Study: ICL Remote Deposit Capture System



Working with Image Cash Letters (ICLs), also known as X9.37 Files, to Resolve Interoperability and Data Integrity Issues

Are you planning to implement or work with a system that uses Image Cash Letters, also known as X9.37 files?

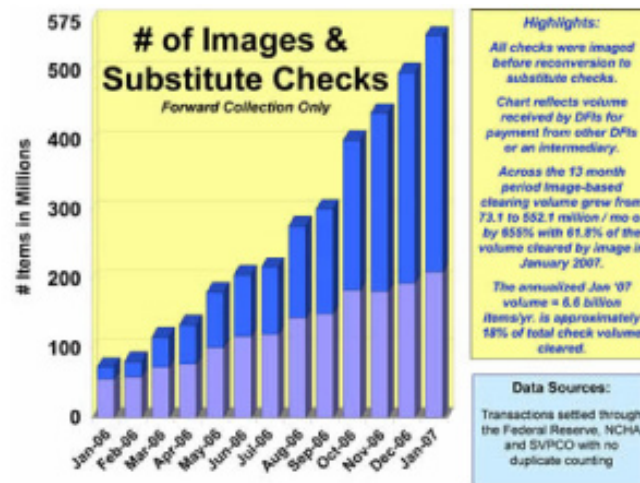
Do you know what is involved in the implementation of a well behaved system that ensures both data integrity and interoperability within a check payment system?

This white paper will fill you in on what you need to know to understand the intricacies of Image Cash Letters. Included is advice on how to implement your system so that it ensures interoperability with multiple systems and maintains data integrity throughout the process.

Image Cash Letters (ICLs) have become the preferred vehicle for transporting electronic check payment transactions between organizations and systems. Although standards were established for ICLs in the 1990s, it was the passing of Check 21 legislation that legitimized the use of substitute checks. This opened the door for the use of a vehicle to transport the electronic information instead of the original item.

The following figure¹ shows the unprecedented growth the industry is experiencing with check image exchange. At the time of this writing, approximately 36% of financial institutions have the capability to receive ICLs for the clearing of their customers' checks.

Figure 1 Growth of Check Image Exchange Volume



2

The main objective of Check 21 legislation was to remove all roadblocks for the implementation of an efficient check clearing system that would decrease check clearing float and improve the safety of the payment system. This was precipitated by the severe economic effects of the 911 terrorist attack in 2001 that caused traffic gridlock and grounded air transportation, preventing the timely clearing of \$47 billion worth of check transactions.

¹ From www.eccho.org

² www.federalreserve.gov/Boarddocs/testimony/2002/20020925/default.htm



Working with Image Cash Letters (ICLs), also known as X9.37 Files, to Resolve Interoperability and Data Integrity Issues

ICLs are used to transport check transaction data including check images between organizations and systems for the purposes of clearing the check payments electronically. Transmitting data electronically has the economic benefits associated with reduced transportation costs and increased velocity of transfer of funds.

Organizations that receive check payments are now able to realize the benefits of earlier access to funds, later cutoff times, reduced transportation costs, and the easy convenience of using ICL in remote deposit applications.

Banks have realized that they can now offer deposit services outside their normal geographical boundaries. Offering remote deposit services has been driven by both demand and the desire of banks to grow and increase market share.

Banks that have migrated to image processing for their check clearing operations also enjoy the benefits of reduced operational costs.

Typical uses for ICLs are:

- Presentment of check deposits to the payee bank
- Clearing of check payments through exchange networks
- Remote deposit of check payments received by a corporation, retailer, government, charitable organization, or other merchant
- Delivery and clearing of return items
- Delivery of check transaction data deposited at international branches and foreign banks
- Formatting of check transaction data for printing of substitute checks, aka Image Replacement Documents (IRDs)
- Delivery of check transaction data to corporations for reconciliation, authentication, and cash management purposes
- Transfer of check transaction data between the institution's systems (high speed capture, remote deposit, ATM deposits, teller deposits, remittance, in-clearing, posting, signature verification, returns)

The evolution of ICL standards, formats, and supporting technology has resulted in a quagmire of interoperability and data integrity issues. Although an early ICL standard was first established in the 1990s, this standard was later declared unsuitable for the intended purposes.

Since then, the implementations of applications that use ICLs have been outpacing the standards organization's ability to produce the supporting ICL standards. Consequently, there are now dozens of different formats and variations of ICLs with no clear road map in place to migrate to a single stable standard.

Implementations have also outpaced the availability of supporting standards for image quality and image formats. Remote deposit and teller capture applications are seeing the use of inexpensive check scanners that have low data quality



Working with Image Cash Letters (ICLs), also known as X9.37 Files, to Resolve Interoperability and Data Integrity Issues

capture capabilities compared to the high speed equipment that was traditionally used in bank operational centers. This has contributed to the data integrity issues of the check data transported in ICLs.

It is no easy task to implement a system that uses ICLs. Acquiring the knowledge to be able to build an interoperable system is complicated because there is not just one specification to learn.

The builder will need to learn several format specifications, various companion documents published by clearing organizations (FRB, SVPCO, etc.) and major banks, specifications of ICL variations used for remote deposit applications, as well as acquire the knowledge of image quality standards and practices, and image format standards.

Standards are still evolving. Additional variations are still appearing. The cost of development and maintaining ICL processing systems will be very high, not to mention the time required to implement them.

All My Papers is the developer and distributor of software toolkits and applications that process, extract data, and print check images.

Our development kits provide the ability to create, view, edit, format, sort, merge, and process X9.37 ICL files. Using these tools will isolate the ICL system implementer from the intricacies of ICL processing.

Data integrity issues are solved with built-in OCR and image processing and repair functions to validate and even correct for poor MICR and image quality. With support of over two dozen formats and variations, we are continually adding formats to meet market demands.

The All My Papers products will benefit anyone contemplating using or implementing a system that will process ICLs. This includes:

- Financial Institutions (banks, credit unions, FRB)
- Image Exchange Network providers
- Corporations, retailers and other merchants who deposit checks and/or need to reconcile check payments
- LockBox Service providers
- IT departments that will implement or manage check clearing systems
- System implementers of check payment clearing systems (capture, clearing, & exchange)



Problem Description

Image Cash Letters Explained

A traditional cash letter is an inter-bank transmittal letter that accompanies paper check items sent from one financial institution to another.

In the simplest case, the cash letter contains checks that were deposited in the sending institution (Bank of Deposit) and drawn on the receiving institution. The financial institutions would settle on the total dollar amount of the items as summarized in the accompanying cash letter.

An Image Cash Letter (ICL) is now an electronic version which includes images of the items instead of the original paper items.

At the time of the Check 21 legislation, the industry did not have a suitable ICL standard to meet the desired requirements.

As an interim solution, the financial industry adopted the use of DSTU (Draft Standard for Trial Use) X9.37–2003 until the desired specification (ANS X9.100-180) could be developed and approved. This desired standard was not approved as an ANSI standard until later in 2006.

ICL File Structure

The ICL has the following basic structure. Refer to specific specifications for more details and options.

```
X9 File (X9.37 or X9.100.180)
  File Header
  1st Cash Letter
    1st Cash Letter Header
    1st Bundle Structure
      1st Bundle Header
      1st Item
        1st Check Detail Record
        1st Check Addendum Records
        1st Check Image View Records
        1st Check IQA Records
      2nd Item
      nth Item
      Credit Item Record (X9.100.180 only)
      1st Bundle Control Records
    2nd Bundle
    . . .
    nth Bundle
      1st Cash Letter Control Record
  2nd Cash Letter
  . . .
  nth Cash Letter
  File Control Record
```

Problem Description

Specific Details about structure:

The X9 file will contain:

- **File Header** with routing origin and destination information and creation date
- **Cash Letter Records** (usually one or more)
- **File Control Record** with summary control totals of # of cash letters, # items, and value (\$)

The Cash Letter Records will contain:

- **Cash Letter Header** with routing origin and destination information and creation date
- **Bundle Records** (usually one or more)
- **Cash Letter Control Record** with summary control totals of # of bundles, # items, # images, and value (\$)

The Bundle Records will contain:

- **Bundle Header** with routing origin and destination information and creation date
- **Item Records** (usually one or more)
- **Bundle Control Record** with summary control totals of # of items, # images, and value (\$)

The Item Records will contain:

- **Item Detail Record** which contains ECE sequence number, amount, payer bank routing number, and the On-U's field containing unparsed account, serial number and Auxiliary On-U's
- **Item Addendum Records** that are used to apply electronic endorsement information by institutions involved in the truncation, routing, IRD printing, and returning of the item
- **Item View Records** that are the actual image of the check; usually the front and rear image views are included with every item
- **Item Image Quality Analysis (IQA) Records** that can contain flags and results of any analysis of image quality of the item's images.

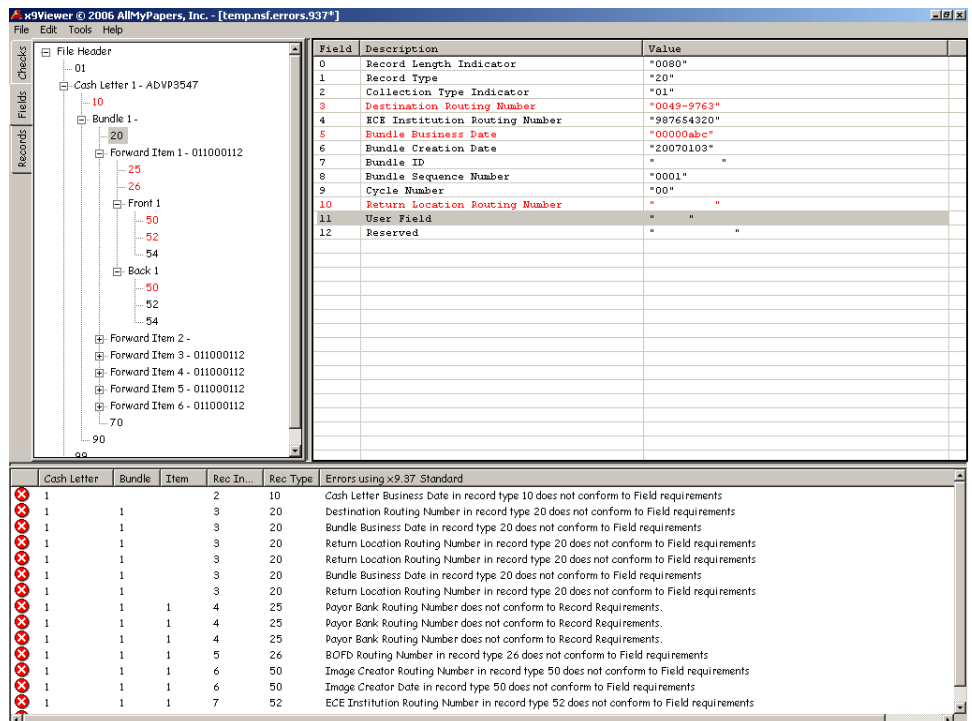


Problem Description

Additionally, a bundle can optionally contain a **Credit Item Record**. This is only officially supported in X9-100-180 but has also been used in many non-standard forms of ICLs (X9.37 files).

The typical use of a **Credit Item Record** is for a Deposit ICL (e.g., remote or merchant capture application) where the depositing bank account details are required to direct where the deposit should be posted. This **Credit Item Record** can be used to represent a deposit slip in an electronic deposit ICL file.

Figure 2 View of a ICL file showing hierarchical structure, field level data and analysis results



The screenshot displays the x9Viewer interface. On the left, a hierarchical tree view shows the structure of the ICL file, starting with 'File Header' (01) and 'Cash Letter 1 - ADVP3547' (10). Under 'Cash Letter 1', there is a 'Bundle 1 -' (20) which contains 'Forward Item 1 - 011000112' (25). This item has 'Front 1' (50) and 'Back 1' (52) sub-items. Below 'Forward Item 1' are 'Forward Item 2 -' (26) through 'Forward Item 6 - 011000112' (70). The tree ends with '90' and '99'.

On the right, a table shows field-level data for the selected record (Forward Item 1):

Field	Description	Value
0	Record Length Indicator	"0080"
1	Record Type	"20"
2	Collection Type Indicator	"01"
3	Destination Routing Number	"0049-9763"
4	ECE Institution Routing Number	"987654320"
5	Bundle Business Date	"0000abc"
6	Bundle Creation Date	"20070103"
7	Bundle ID	" "
8	Bundle Sequence Number	"0001"
9	Cycle Number	"00"
10	Return Location Routing Number	" "
11	User Field	" "
12	Reserved	" "

At the bottom, an error analysis table titled 'Errors using x9.37 Standard' lists various errors:

Cash Letter	Bundle	Item	Rec In...	Rec Type	Errors using x9.37 Standard
1			2	10	Cash Letter Business Date in record type 10 does not conform to Field requirements
1	1		3	20	Destination Routing Number in record type 20 does not conform to Field requirements
1	1		3	20	Bundle Business Date in record type 20 does not conform to Field requirements
1	1		3	20	Return Location Routing Number in record type 20 does not conform to Field requirements
1	1		3	20	Return Location Routing Number in record type 20 does not conform to Field requirements
1	1		3	20	Bundle Business Date in record type 20 does not conform to Field requirements
1	1		3	20	Return Location Routing Number in record type 20 does not conform to Field requirements
1	1	1	4	25	Payer Bank Routing Number does not conform to Record Requirements.
1	1	1	4	25	Payer Bank Routing Number does not conform to Record Requirements.
1	1	1	4	25	Payer Bank Routing Number does not conform to Record Requirements.
1	1	1	5	26	BOFD Routing Number in record type 26 does not conform to Field requirements
1	1	1	6	50	Image Creator Routing Number in record type 50 does not conform to Field requirements
1	1	1	6	50	Image Creator Date in record type 50 does not conform to Field requirements
1	1	1	7	52	ECE Institution Routing Number in record type 52 does not conform to Field requirements

Issues with ICL Files

This section describes the major problems typical with ICLs. The planners of a system that will process ICLs need to be aware of these issues so they can incorporate technologies and processes that will minimize the associated risks.

Problem # 1: DSTU X9.37 vs. X9.100.180

The Accredited Standards Committee (ASC) X9B for developing standards for ICLs permitted the use of a temporary standard until the desired standard was ready. Unfortunately, the desired standard, X9.100-180, took from 2003 to 2006 for development and approval. During this time there was a rapid adoption rate of using ICLs fuelled by the demand of IRD and remote deposit services.

The temporary DSTU X9.37 2003 was widely adopted, making it difficult to migrate to the new replacement standard. The financial industry intends to migrate to this new standard beginning in 2008, but the migration path is not yet clear.

Problem # 2: DSTU X9.37 functionality

It was recognized that the DSTU X9.37 standard did not meet all requirements for ICL uses. To overcome these limitations, users had to allow non-standard modifications to X9.37 to support applications that required certain features.

Support for credit item records is the most significant feature resulting in several X9.37 variations. We will spend some more time on this topic later.

Problem # 3: Flexibility in a standard may not be a good thing

The ASC X9B committee for developing standards for ICLs had good intentions in developing a flexible standard. The standard contains many optional records and user defined fields. The actual use of these optional records and user defined fields is left up to agreements between exchange partners.

This flexibility has left the door open to many different variations and interpretations.

Problem # 4: The United States Check Clearing Process

Providing check clearing services is a competitive and very lucrative market, with many players scrambling to win their market share. Service providers typically have their own companion documents to the X9.37 file standard, detailing their rules on how to format the ICL file for their own exchange networks. This has resulted in many different variations of the X9.37 ICL format.

The following is a list of some of the organizations who provide ICL Clearing/Exchange services today.

- Federal Reserve Banks
- Fiserv
- Viewpointe
- EDS
- SVPCO
- Open Solutions
- Endpoint Exchange

Issues with ICL Files

Problem # 5: Credit Records and the Growth of Remote Deposit

Remote deposit applications usually require credit item records, which were not supported in the DSTU X9.37 2003 specification.

Financial institutions that were racing to provide remote deposit services for their customers were forced to implement non-standard and proprietary means of using credit records in the X9.37 based ICL files. Most major banks now have their own proprietary variations of X9.37 files using credit item records.

Problem # 6: Improper ICL Formatting

Possibly the biggest problem is that ICLs are just not being formatted correctly.

The X9 specifications are complex, making it challenging to implement accurately. There is no simple way to certify that formats are accurate. It is also easy to make different interpretations or make wrong assumptions about the formats and contents of the ICL files. Common examples of ICL formatting problems include:

- Missing records
- Missing fields
- Missing field contents
- Invalid data types
- Missing images
- Incorrect image formats
- Wrong images
- Wrong record counts
- Incorrect sequencing

Problem # 7: Duplicates

A paper check can now be truncated (destroyed), converted to electronic data and reprinted as an IRD. This has created a new risk of creating duplicate transactions. Most of the reported incidents are accidental in nature but there is also the risk of fraudulently created duplicate transactions. Common errors leading to duplicates include:

- Item presented twice by original check, IRD, and/or ICL
- IRD duplicated
- Electronic item, bundle, or cash letter duplicated and sent in different ICL files
- ICL file duplicated and sent twice
- Item captured twice (an easy mistake in remote deposit applications that could also be intentional)

There is also the risk of a duplicate transaction if the original check is converted to an Automated Clearing House (ACH) transaction. ACH is the USA bulk electronic payment network. Under NACHA³ rules, checks are allowed to be converted to an electronic debit transaction and cleared through the ACH network. The ACH network does not clear image data with these transactions.

³ National Automated Clearing House Association (www.nacha.org)

Data Integrity Issues

The ICLs transport the image and MICR data captured from paper check transactions. The accuracy and usability of these data elements is essential to the clearing and processing of the transaction. Users need to be aware of data integrity issues when planning the implementation of a system that uses ICLs.

Data Integrity Issue #1 – Image Formats

An image file contains a bitmap or raster format of the image, but also includes important information about the image in a header that allows viewers and systems that will process the image to interpret the image data correctly. Included in the header will be information about the size, resolution, compression, orientation, and other details. There are several types of image file formats used that include TIFF, JPEG, GIF, BMP, and others.

The financial industry has adopted TIFF 6.0⁴ as the preferred image format for check images. This standard was established in 1992 and used extensively. Unfortunately this standard also suffers from having a lot of flexibility that has resulted different interpretations. There are many real examples of interoperability problems where systems that process images are incompatible with the TIFF variation produced by capture platforms.

In defense, the financial industry has recently prepared a standard⁵ that specifies the rules for using TIFF 6.0. As this is a recent standard it will take considerable time to totally eradicate the noncompliant image formats that can only be fixed with system upgrades. Examples of noncompliant image format variations that commonly exist in ICLs today include:

- Non TIFF format
- Not using CCITT G4 compression
- Color or grayscale JPEG image instead of required black/white image
- Incorrect resolution
- Stripped TIFF (image stored in multiple memory blocks instead of only one)
- Multi-page TIFF (multiple views in one file instead of only one)
- Incorrect orientation
- Incorrect photometric (0-white, 1- Black)
- Incorrect bit/byte order

Data Integrity Issue #2 – Image Quality

There are many challenges in capturing high quality usable images of checks, and it requires a well designed capture system that incorporates best practices to ensure high quality results. The financial industry is still in a learning curve about image quality so there are few examples of well designed capture systems. A substantial number of poor quality images are being captured and attempted to be exchanged via ICLs.

⁴ Tagged Image File Format (<http://partners.adobe.com/public/developer/en/tiff/TIFF6.pdf>)

⁵ ANS X9.100-181 Specification for TIFF Image Format for Image Exchange

Data Integrity Issues

Exchange networks may implement some form of Image QA, with the best example being the Federal Reserve Banks. They have implemented a system that analyzes incoming images using a variety of IQA tests. Any item that fails the automated inspection process is rejected. The originator either needs to recapture a better image or clear the paper item. This can be challenging, as many times the original item was captured at a remote location.

It also must be understood that automated IQA analysis technology is not perfect and will make mistakes by rejecting good items and letting bad items pass. Users of ICL systems need to be aware that they will receive some unusable poor quality images in ICLs, and that there is a risk of having items rejected in sent ICLs if the images did not meet quality thresholds.

There are also risks if the users of an ICL system need to produce IRD documents from poor quality images contained in ICL files.

Examples of common image defects that cause usability problems:

- Partial Image
- Image too dark or light
- Excessive skew
- Excessive noise
- Piggy-back
- Wrong image

The cause of these types of defects can be related to the source document (non-compliant to design standards, light printing from worn ribbon or use of gel pen, document torn, folded or mutilated). The capture hardware can also cause image defects especially with the migration to low cost check scanners in remote deposit and branch teller capture.

Data Integrity Issue #3 – MICR Read Quality

The migration from using high speed reader sorters for capturing checks to inexpensive low speed desktop check scanners is causing another data integrity issue: poor MICR read quality. Traditionally the financial industry has lived with 1-2% reject rates, with below 0.1% misread rates, in capturing the check's MICR information.

Users of low cost, low speed check scanners are now experiencing misread rates of greater than 1%, with reject rates that range from 5% to 15% and sometimes even higher. In 2006 Silver Bullet Technology, Inc. published their findings of an independent benchmark test in their "Small Check Scanner MICR Read Performance Benchmark Study" report that confirms this poor MICR read performance.

MICR data may also have been captured or corrected by manual keying, which can introduce errors in the MICR field data captured.

⁶ http://www.sbullet.com/documents/SmallCheckScannerMICRStudySummary_022706.pdf



Costs Associated with Bad ICL Files

The use of ICLs will have a direct impact on operational costs. There are also costs associated with increased risk exposures, and costs associated with loss of customer satisfaction.

Operational Cost Impacts

ICLs with issues create additional operational costs. A bad ICL requires exception handling procedures to correct the file, or requires alternate clearing procedures such as locating and clearing the original paper checks.

High rejects and misreads in MICR field data increase operational costs by requiring manual correction or processing exceptions resulting from wrong postings and mis-routings.

Poor image quality increases operational costs by requiring inspection, recapture, paper archiving, and processing exceptions resulting from returns for unusable quality.

Investment Income Cost

A bad ICL can cause a clearing deadline to be missed. As volume in image exchange continues to rapidly increase, the potential for very high value ICLs is also increasing. Missing the deadline on a high value ICL impacts float, causing a loss in investment income.

Increased Risk Exposure Costs

A missed clearing deadline also means increased risk for non-payable items that can no longer be collected. Data integrity issues with the item's MICR and image data can cause processing delays in clearing, resulting in increased risk exposure.

Customer Satisfaction Costs

The costs associated with dissatisfied customers are immeasurable but very high. Customer Service processing is expensive and time consuming.

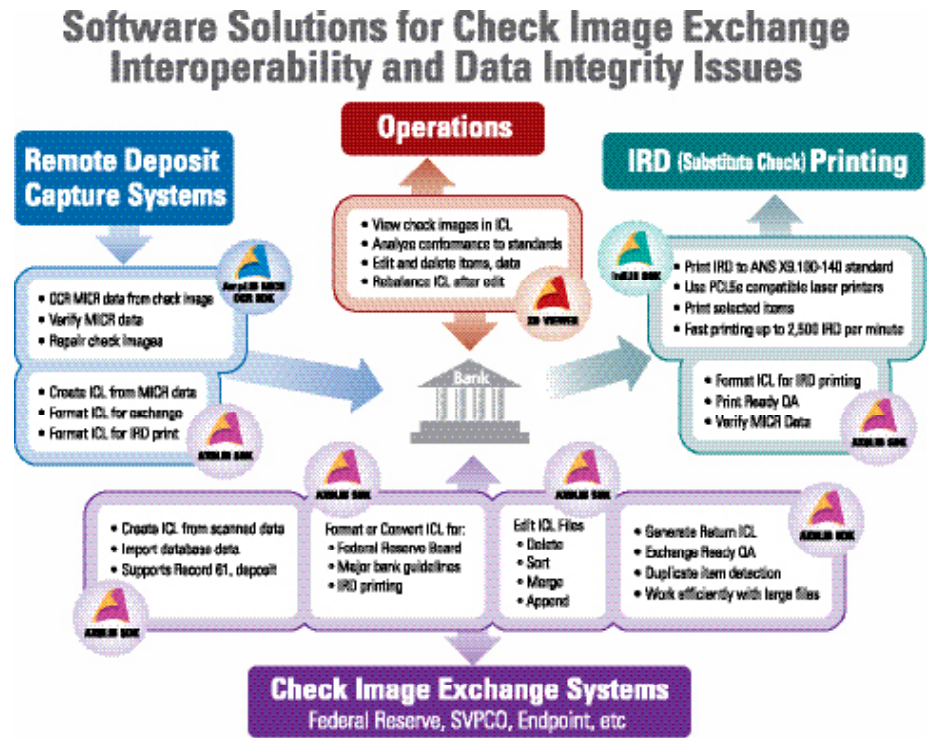
The higher rate of misreads in MICR account fields, particularly the Account field, will result in checks being posted to a wrong account. This leads to very dissatisfied customers, and even potential liabilities to the financial institutions.

Customer dissatisfaction will also result if the images of their cleared checks printed on IRDs are not legible due to poor image quality. A double posting resulting from receiving a duplicate item is another risk that can lead to customer dissatisfaction.



**All My Papers –
Solutions for ICL
Interoperability and
Data Integrity**

This diagram shows the architecture of ICL processing using technologies from All My Papers.



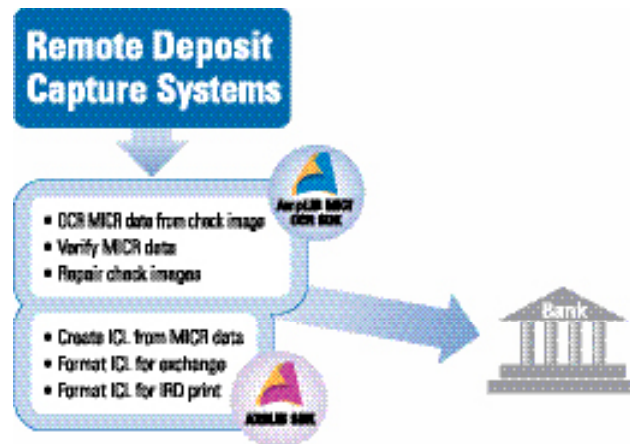
All My Papers has technology for all the possible ICL interface processing points that a financial institution might have, including:

- Building ICL files from captured data
- Processing ICL files sent/received through exchange networks
- Processing ICL files sent/received directly from other banks
- Processing received ICL files from Remote Deposit customers (can include corporate, correspondent banks, and international deposits)
- Printing IRDs from ICL files
- Internal processing of ICL data within the financial institution



All My Papers – Solutions for ICL Interoperability and Data Integrity

Here is how All My Papers technology can be applied to all these interface points to solve all your interoperability and data integrity issues.



If your intention is to truncate checks and create ICLs, then your considerations for data integrity need to start in your capture system. To ensure your system is capturing good MICR data (particularly if you are using desktop check scanners) your system needs to employ technology that will automatically correct rejects and misreads at the time of check image capture and scanning, before formatting the data into ICL files.

Point of capture is the best time to ensure high quality images are being captured. Detecting image quality problems early in the process also provides the best opportunity to access an original item to capture a better image or clear paper item.

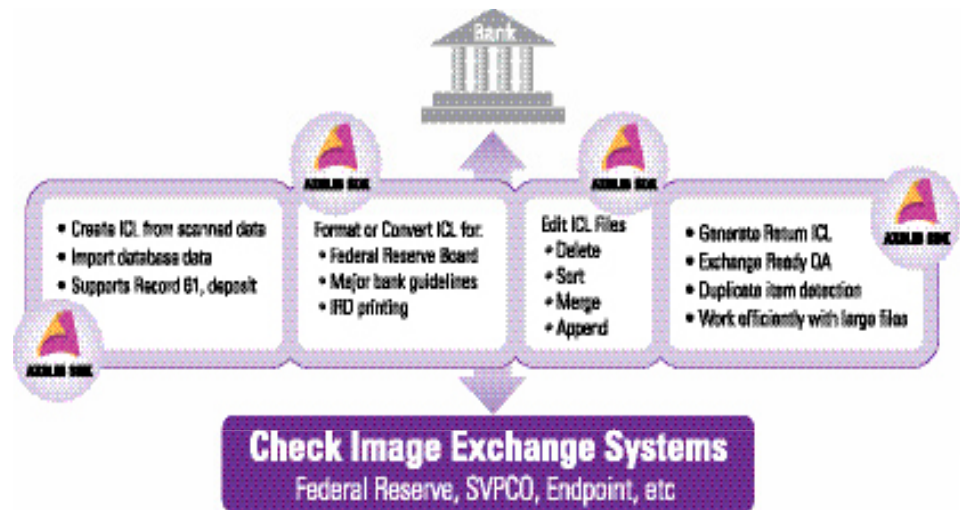
MICR Read Quality data integrity problems are solved using All My Papers MICR OCR and Verify technology that will read the MICR line from the captured image using multiple OCR engines. These results will be combined with the MICR line captured by the hardware device and will use voting technology and code line syntax rules to produce accurate MICR reads. MICR Verify also applies OCR read retries with image enhancement and image repair techniques to produce highly accurate results in even the most difficult situations. All My Papers MICR Verify will reduce rejects and misreads to levels below what was previously experienced in high speed capture environments.

Image Format and Image Quality data integrity is ensured with All My Papers "Exchange Ready" technology that tests every image for conformance to exchange standards. AMP ensures image formats are in compliance with the new X9 TIFF standards and tests every image for the common forms of image defects. All My Papers also provides automatic image processing functions that can correct many common types of image defects.

Data Integrity issues of image and MICR data received in ICL files, regardless of their source, can also be solved by All My Papers MICR Verify and Exchange Ready technology. These functions can be applied to incoming ICL files to detect and correct for data integrity issues for received MICR and image data. These functions are available in our Software Development Toolkits.

All My Papers – Solutions for ICL Interoperability and Data Integrity

Issues with ICL Files



Consideration also needs to be given to your application that will build the ICL files to ensure proper formatting and compatibility to the specific format required by the endpoint or exchange network. Your system that imports data from received ICLs also needs to have consideration for the variation in formats that are possible to receive, and also have tolerance built in for processing ICL files that are not perfectly formed.

All My Papers AX9LIB is another AMP SDK that isolates the user from the intricacies of the ICL formats. It provides supports for dozens of popular X9.37 ICL format variations. Building ICLs or importing data from ICLs is simplified to basic programming functions. The programmer does not need to have detailed knowledge of the specifications, companion documents, or rules associated with the endpoint or exchange network. The SDK enables a rapid time to market and greatly reduces ongoing support efforts by including demo programs with source code.

AX9Tools – AX9LIB Command Functions with Professional Customization Service

All My Papers provides professional services to perform the ICL processing/conversions you require for your ICL system. Typical implementation times are only a few days.

All the functionality of AX9LIB is provided by command functions that can be used in a batch process to perform processing on ICL files. ICL processing applications can be prototyped, demonstrated, developed, and tested very quickly without the need for any special development resources.

Your ICL processing requirements may also need to perform clearing of ICL files. You may be receiving ICL files and need to extract, sort, merge items, bundles and/or cash letters to create output files for exchange clearing, exception processing, or IRD printing. All My Papers AX9LIB SDK provides a feature-rich set of functions for performing all these editing functions on ICL files.

All My Papers – Solutions for ICL Interoperability and Data Integrity

If your ICL application is used for clearing, you need to plan defense measures for duplicate detection. All My Papers Fingerprint technology calculates a unique digital context message which is like a fingerprint for ICL files, cash letters, bundles, items, and images. Duplicates of files, cash letter bundles, items, and images can be detected.

Your ICL application may be processing hundreds of thousands of ICL letters. How will you be able to manage all this data coming and going? All My Papers AmpSQL product supports X9.37 ICL file import and export capabilities on top of a SQL database. All data elements of an X9 file can be exported to the database. A feature-rich set of web pages provides web research services to search and view data sent and received in X9.37 files. AmpSQL incorporates the All My Papers Fingerprint technology to detect duplicates in received data. Alerts of detected duplicates can be forwarded in emails to users of the system.

Operations

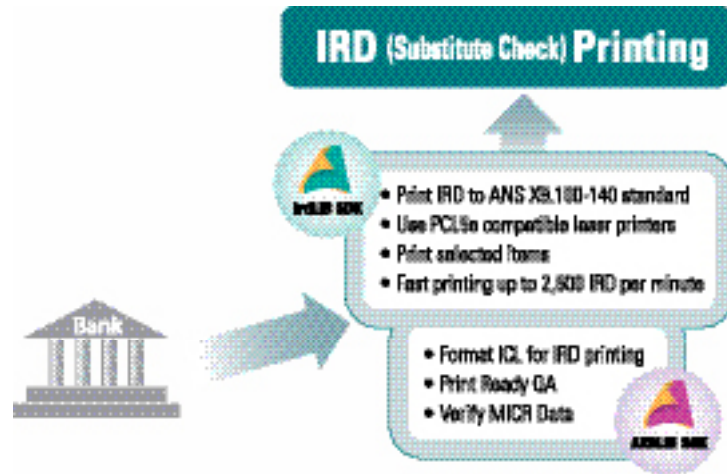


All My Papers X9 VIEWER is a standalone application that can open, analyze, view, edit, and even convert X9 ICL files. ICLs are getting larger, representing millions of dollars, containing more check items (sometimes more than 40,000) and reaching multiple gigabytes in file size. One “bad” item can stop a transmission or reception.

This tool can be used to ensure files are compliant to the various formats supported, and to identify formatting or data type problems. The All My Papers X9 VIEWER has an additional feature that can be used to edit data contents of X9 format ICL file and correct problematic format and data problems.

**All My Papers –
Solutions for ICL
Interoperability and
Data Integrity**

IRD Printing



Will your system be printing IRDs from ICL files received or created internally? Data integrity is crucial for IRD printing. Bad ICL data can cause an IRD to be printed inaccurately or not at all. More severe ICL format problems can cause the entire IRD printing batch job to fail, leading to processing delays and missed deadlines. Consideration also needs to be given to volume, clearing deadlines, which IRD compatible printers need to be supported, and location of the printers. To minimize transportation time and costs it may be preferred to have the printers locally located in the region that receives the IRDs.

The All My Papers IRDLIB Software Development Kit for IRD Printing incorporates multiple technologies to ensure reliable, fast, and accurate printing of IRDs. All My Papers “Print Ready” technology is used to identify and filter out items that cannot be printed due to data integrity or formatting issues. This ensures IRD batch printing jobs can be processed without delay and interruption. Exceptions can then be treated separately without affecting the main processing flow. IRDLIB SDK supports a wide range of popular IRD compatible printers. These can be network connected printers allowing centralized management and control of IRD printing processes with locally located printers.

About All My Papers

All My Papers is the developer and distributor of software toolkits and applications that process, extract data, and print check images.

All My Papers develops and distributes products for accurate and fast:

- Printing of Image Replacement Documents (IRDs)
- Data extraction of the MICR line data on check images

All My Papers products are used by hundreds to read millions of images every day.



All My Papers Products for ICL Processing Applications

AmpLIB MICR OCR Software Development Kit

The AmpLIB SDK contains all the **functions** necessary to perform the MICR OCR and MICR Verify operations required to autocorrect rejects and misreads in MICR information captured on check scanners and received in ICL files.

Functions

- Finds, reads, parses, extracts, verifies, and saves the MICR data from the check image at rates up to 20 images per second per CPU core, with low reject rates
- Delivers accurate and fast Optical Character Recognition (OCR) of MICR line data from check images
- Provides a complete SDK consisting of everything you need to reliably extract MICR data
- Searches a check image automatically for the MICR line and rapidly outputs the results with accuracy and reliability using its dual pass OCR voting algorithm
- Generates confidence values which can flag questionable images and maintain low error rates
- Invokes ABA or local banking rules when considering rejecting a character
- Saves significant time and provides maximum flexibility to customize solutions, because we've already done the complex, low-level programming
- Delivers automated image check processing with low reject rates

AX9LIB Software Development Kit

The AX9LIB SDK uses a Windows™ suite of software tools to **create, format, and edit** Image Cash Letter (ICL) files in X9.37 and ANS X9.100-180 format to solve interoperability file and data integrity problems associated with check image exchange.

Create

- Create X9.37 files with a single function call using data from remote deposit check scanners.
- Convert check image database data (CSV format) to valid X9.37 files
- Create check image exchange files with Record 61 deposit items
- Create files conforming to Accredited Standards Committee (ASC), Canadian Payments Association (CPA) and X9B standards



All My Papers Products for ICL Processing Applications

Format

- Format & validate files to the Federal Reserve Board, SVPCO, ECCHO, and other check image exchange guidelines
- Convert from standard X9.37 files to various bank and exchange formats
- Format Image Cash Letters for IRD printing
- Perform QA on X9B formats to insure full compatibility to exchange standards or printing IRDs
- Automatic format of FORWARD X9.37 to RETURN X9.37 files

Edit

- Delete cash letters, bundles, or items with automatic rebalance of control records in check Image Cash Letters
- Generate a “Pick List” of items for exception, forward, or return processing
- Sort, merge, append, and pre-pend items
- Detect duplicate check items, bundles, and ICLs
- Work efficiently with large ICLs, 40,000+ items

The SDK allows the rapid development and deployment of applications for dealing with Image Cash Letters in a virtual way, just as banks are used to working with paper checks, bundles and cash letters.

AX9LIB consists of Microsoft Windows™ compatible Dynamic Link Libraries, an associated import library, header files, and other support files that can be used by a wide variety of programming languages and systems.

DLL Based API AX9LIB is built as a set of Dynamic Link Libraries (DLLs). This provides a degree of language independence between AX9LIB and a user-written application.

AX9LIB Software Development Kit includes a COM object for the AX9LIB DLL. The COM object puts a “friendly face” on the AX9LIB Application Program Interface (API) making it more convenient to use in programming environments such as C#, C++, Visual Basic, and Java that support COM objects.



All My Papers Products for ICL Processing Applications

X9 VIEWER

A Windows™ .NET application to identify and resolve interoperability and data integrity issues in check Image Cash Letter files.

Receiving and sending multiple ICLs is now a daily occurrence at financial institutions. The X9 VIEWER can be used in each of these departments:

Operations

- Fix errors in ICL Files and auto-rebalance
- Validate conformance to check image exchange guidelines
- View BOFD Information
- Certify files to and from exchange partners

Development

- Highlight non-conforming errors to standards and guidelines
- Compare check images to Record and Field data
- Disassemble ICLs to CSV components
- View Record 61 Deposit information Testing

Testing

- View files before IRD print
- Conformance testing to exchange guidelines for ICLs
- Quality Assurance Testing to compare check images to data
- Create test files

There are three functional versions of the product:

- **FREE version** - allows the viewing of check images only in X9.37 files (not available for X9.100-180)
- **Viewer/Validator version** - licensed version, views check images and associated record data for either X9.37 or X9100.180 file types and analyzes the file for conformance to the respective ANSI Standard
- **Editor version** - licensed version, allows editing, deleting of bundles, items, records, and fields and re-balancing of ICLs plus the viewing and conformance testing



All My Papers Products for ICL Processing Applications

X9 QUALIFIER

A Windows™ .NET application which tests the data integrity of X9.37 Image Cash Letters to ensure their interoperability in check image exchange.

The X9 QUALIFIER complements the X9 VIEWER:

- Use X9 VIEWER view, edit, and analyze the data contents of an ICL file
- Use X9 QUALIFIER to detect data quality problems in the MICR and image data with an integrity check of the ICL file

Applications

- Check Image Exchange--Operations staff can use X9 QUALIFIER to ensure that items in exchange ICL files conform to exchange standards when sending ICL files, and will not be rejected or returned for quality issues. When receiving ICL files, X9 QUALIFIER ensures the data is compatible with your in-clearing system and will not cause any system failures
- Certification of Capture Systems--System developers and testers can use X9 QUALIFIER to ensure that capture hardware and capture software are outputting both accurate and conforming MICR and image data
- Certification of Remote Deposit Customers--A financial institution's staff can use X9 QUALIFIER to ensure that customers' systems which are creating deposit ICL files are both accurate and conforming
- ICL Analysis--IT staff can use X9 QUALIFIER to troubleshoot issues with problematic X9.37 ICL files, and use the linked X9 VIEWER to research non-conforming items
- Performance Analysis--System analysts can use X9 QUALIFIER to measure the performance and accuracy of the capture systems used to create MICR and image data contained in the ICL
- IRD Printing--Operations staff can use X9 QUALIFIER to ensure image and MICR data in ICL files is accurate and can be used to print conforming Image Replacement Documents
- Exception Processing--Operations staff can use X9 QUALIFIER to detect items with data integrity issues to allow removal for exception processing

Features

- Tests and certifies TIFF check images for conformance to X9.100-181 "Tough TIFF" standard
- Tests images for conformance to ECCHO recommendations on IQA testing
- Detects MICR Mismatches: Items with MICR data not matching the data on the image, and items with misreads or keying errors



All My Papers Products for ICL Processing Applications

- Tests that the X9.37 files are properly formatted and balanced
- Allow presets that can automatically set parameters and select tests for Federal Reserve Bank, major bank, and other common test subsets

There are three functional versions of X9 QUALIFIER:

- **FREE X9 QUALIFIER version** - tests and certifies the integrity of data in X9.37 ICL files. The free version does not support MQA and some IQA tests and only gives an overall PASS OR FAIL indication
- **Certifier & Reporter version** - permits the viewing and reporting in detail of items that fail the data integrity tests. The MICR Mismatch option enables the MQA tests
- **Corrector and Qualifier version** - not only analyzes X9.37 files to find non-conforming items, but can also correct for many TIFF conditions. Two correction modes support correction for image exchange and IRD Printing

IRDLIB Software Development Kit -- IRD Printing

IRDLIB SDK delivers accurate and fast conversion of check image data from X9.37 or CSV files into valid Image Replacement Documents.

IRDLIB SDK reflects the latest implementations and rules by the Federal Reserve Board of the ANSI Standard because the principals of All My Papers are voting members of the X9 committee that develops the standards for IRDs and X9.37 files. IRDLIB SDK is X9.100-140 Compliant.

IRDLIB SDK has two major components.

- Composing valid IRDs from the appropriate records in X9.37 files can be done on a number of PCs using our COM Object based functions that would be incorporated into your custom application
- Printing happens at the workstation that has logical control of the IRD printer(s) and has the XipPRINT DLL and runtime software installed

The advantage of this arrangement is that a number of networked PCs can produce the IRDs, and a centrally located and secure PC can print the IRDs. Network traffic is minimized because the check image data is compressed until it arrives at the printer.

AmpSQL is a standalone application that imports and exports X9 ICL files to a SQL database. All data elements of an X9 file can be imported to the database. A feature-rich set of web pages provides web research services to search and view data sent and received in X9 files.



Case Studies

AmpSQL incorporates the All My Papers Fingerprint technology to detect duplicates in received data. Alerts of detected duplicates can be forwarded in emails to users of the system.

The system incorporates watch folders to detect the arrival of files to invoke automatic loading and workflow processing.

In the next section we will describe problems faced by real customers, and how they applied technology from All My Papers to overcome these problems.

1. Case Study: Remote IRD Printing

The Customer A large national bank

The Opportunity IRDs provide the opportunity to save on transportation costs and to speed clearing if the data is transmitted for local printing at the location where the IRD is required.

To take advantage of this opportunity, this customer decided to establish remote IRD print locations distributed across the nation. These would all be controlled from centralized operations processing centers.

The Problems Data integrity issues with ICL files used for the purposes of IRD printing can cause IRDs to be printed incorrectly or not at all. More serious issues have the potential to cause the entire IRD batch printing process to fail. This can result in missed clearing deadlines and can increase operational expense to process the exceptions created.

This customer was receiving ICL files from multiple sources both internal and external to the bank, including international branches. Data integrity issues with the ICL files received created challenges for reliable and accurate printing of IRDs at remote locations. Data integrity issues included incorrectly formatted ICL files, high MICR mis-reads, wrong image formats, and image quality problems.

The Solutions An All My Papers business partner chose All My Papers IRDLIB SDK to provide the tools to print IRDs from ICL files. The custom application allows the ICL file to be loaded at the centralized operational center and creates a print spool job that can be sent to a variety of networked connected printers at the remote locations across the nation.

The customer also uses All My Papers AX9LIB SDK to pre-process ICLs before they are sent to the printers. The tools include a function called "Print Ready" that checks the ICL file for any issues that might cause a IRD to not be printed, to be printed incorrectly, or to cause a total print job failure.



Case Studies

The “Print Ready” function signals if there are major issues with the ICL or generates a list of items that fail the “Print Ready” criteria. This customer then uses the list to remove the exception items, allowing the IRD printing process to continue trouble free. Exception items are built into exception ICLs for exception processes.

In many cases, All My Papers AX9LIB functions allow for automated repair of the data integrity issues. MICR Verify is used to detect and correct for MICR misreads. Non-repairable items are assembled into return or other exception ICL files for further processing.

Detecting and removing bad items early in the process enables an efficient and reliable IRD printing process.

Exception processing also is controlled and initiated early in the process and totally managed at the centralized operations center. Exceptions are detected and removed promptly, preventing any delays in clearing caused by problems in the bulk IRD printing process.

With the tools provided by AMP, the national bank can repair data integrity issues before files are sent to the remote IRD locations.

2. Case Study: Supporting Proprietary Bank ICL Format

The Customer A small correspondent bank

The Opportunity This correspondent bank wants to take advantage of the opportunities afforded in using ICLs by transmitting its check deposits electronically to its check clearing service provider.

Transmitting the deposits electronically shortens the clearing cycle and allows a later cutoff time.

Transportation and operational costs also go down as paper processing is reduced.

The Problems The large financial institution that provides deposit services to this correspondent bank had adopted a proprietary format extension of X9.37 that supported deposit tickets in the transactional data.

The correspondent bank was using the standard X9.37 ICL file formatted to the rules provided in the Federal Reserve Bank’s X9.37 companion document.

The correspondent bank needed a way to convert to the proprietary format so it could take advantage of the opportunities provided by Check 21.



Case Studies

This bank's solution provider did not have support for the proprietary Remote Deposit ICL format, and did not have the programming resources required to make the necessary conversion within the constraints of the bank's schedule and budget.

In addition, the service fee schedule of the large financial institution provided for savings if the total number of bundles could be reduced. The customer wanted a way to merge items in different bundles into single bundles while still adhering to a maximum bundle count.

The Solutions

The correspondent bank and its solution provider contracted the professional services of All My Papers to develop a custom process using the All My Papers AX9Tools command functions to convert from the FRB X9.37 format version to the large financial institution's proprietary format.

This batch process automatically calculates the credit amounts for the bundles, then formats and inserts a credit record for the deposit transaction using account information configured in the initialization files. This same batch process is able to both merge and split bundles, creating deposit ICL that minimize the service fees payable.

The large financial institution's proprietary format is one of the many variations supported in All My Papers tools.

The customization cost to the correspondent bank was very low, with an implementation time of less than one week, including definition, parameterization, system and acceptance testing.

By using the technology and professional services of All My Papers, the correspondent bank was able to quickly implement and use the remote ICL deposit services provided to them by their service provider and immediately take advantage of the opportunities this provided.

3. Case Study: Viewing, Conformance Testing, & Editing ICLs

The Customer A large national service provider of check clearing services

The Opportunity The benefits of using ICLs for check clearing are numerous, and the financial industry is scrambling to implement the services.

Users of ICLs need to clear ICL files between financial services and need to use exchange services. Several organizations have established ICL clearing services. This customer is one of these organizations.



Case Studies

The Problems

With so many sources of ICL files, receiving ICL files with interoperability and data integrity issues is a certainty.

This customer needed to build in safeguards to ensure problematic ICL data was prevented from being cleared and would not create any catastrophic failures of the entire clearing system.

It also needed to be sure that the output formats it created to send to financial institutions conformed to the X9.37 standard and its own rules.

To minimize the risks associated with interoperability and data integrity issues, this customer needed to be able to certify that the ICL files created by its own customers conformed to the required standards and companion documents.

To assist its customers in implementing their ICL processing systems, it needed to be able to diagnose problems that their ICL files produced. In addition, this customer needed to be able to test that the safeguards built into the clearing system did indeed work, and required test case samples for its system testing.

The Solutions

This customer chose to use the All My Papers X9 VIEWER application to certify that ICL formats conform to the X9.37 standard and supporting companion documents for its exchange system. In addition, X9 QUALIFIER proved useful as a front-end to X9 VIEWER to accelerate the locating of nonconforming items.

To certify that a customer's system is producing compatible ICL formats, this institution will inspect ICL samples provided by using the X9 VIEWER and analyzer capabilities.

This application analyzes the ICL formats immediately upon opening and highlights any issues discovered. The institution is able to quickly confirm conformance and also provide a diagnosis of any issues discovered during the certification process. It is able to certify its own output formats using the same tool.

This customer has built in many safeguards in its clearing system to ensure that ICLs with interoperability and data integrity issues are detected and prevented from entering the clearing system. To test these safeguards, the customer uses the X9 VIEWER Edit capability.

The edit functions allow creation of test files that do not conform. Records can be deleted, fields can be erased, or



Case Studies

incorrect data entered. It is even possible to create test ICL files using a simple text editor and some sample images. Using this tool, the customer is able to create test cases to ensure that its system is able to detect and reject problematic ICL files.

In addition, when its system does detect and reject a non-conforming ICL file, it is able to diagnose what is wrong with the file and provide feedback to its own customers to enable them to make the necessary corrections to their ICL processing systems.

The AMP X9 VIEWER minimizes the risks of interoperability and data integrity issues for this customer, and provides valuable tools for testing and analysis.

4. Case Study: ICL Return Processing

The Customer A midsize national bank

The Opportunity Using ICLs for sending returns increases the benefits gained by implementing an end-to-end electronic check system in a financial institution.

This customer wanted to increase its competitiveness in the marketplace by realizing these opportunities and by implementing an ICL return clearing system.

The Problems A financial institution has three options to implement a return clearing system when forward items are received in an ICL:

1. Print up a return IRD and send it for return clearing
2. Print up a return IRD, then image it in the capture system and create a return ICL
3. Create a return ICL using the items records from the forward ICL

Clearly the third option maximizes the benefits of electronic clearing as it eliminates the need for any further paper processing.

But the customer had no existing system that could be used or modified to perform this function.

Also this customer did not have an image-enabled return processing system that allowed it to perform research on the images of the exception items.

The Solutions This customer was able to implement an image-enabled



Case Studies

return ICL processing system very simply and quickly using technology from All My Papers. The bank already had developed an inclearing system using an application built using the All My Papers AX9LIB SDK product.

With a list of the posted exceptions, this customer used the All My Papers X9 VIEWER to research the items, and generate a list of returns.

The customer now uses a simple but efficient return ICL generation application using the functions provided in the AX9LIB SDK.

The return ICL generation function only requires the forward ICL with a return list. The function copies the return item records from the forward ICL, builds a new ICL, then creates and adds the required return records for the item to process.

Using the tools and applications from All My Papers, this bank was able to quickly (less than 30 days) implement a complete end-to-end ICL clearing system that maximized the benefits provided by image exchange.

This customer does not have to concern itself with the intricacies of ICL formats.

The All My Papers tools produce simple comma separated text file input and outputs to its ICL processing systems, making it easy to interface to its existing posting account system.

Return ICLs are easily generated, needing only a text file containing the list of returns with reason codes.

The X9 VIEWER provides a simple but effective research tool for inspecting image and transaction data received in ICL files.

5. ICL Remote Deposit Capture System

The Customer Remote Deposit Solution Provider

The Opportunity Providing remote deposit services became the first priority for this financial institution.

This application provided the most benefits to the bank's corporate clients.

This service removes geographic boundaries, giving banks a new growth area, and giving opportunity to the solution providers that can provide remote deposit products to



Conclusion

these financial institutions.

This customer saw an opportunity to establish a third party remote deposit clearing service via the internet.

Using a web based client, customers could provide the images and MICR of their deposits. This data would be formatted and then sent to the customers' desired banks for deposit. Customers would have the option of using their own scanners and capture applications.

The Problems

This type of solution created challenges for both data integrity and interoperability.

The provider had no control over the capture environment, yet was responsible to ensure the data integrity of the MICR and image data.

Its customers also had the flexibility to choose to which bank the deposit ICL was to be sent. This meant the customer needed to be sure the ICL formats produced met the remote deposit format requirements of the respective institutions, requiring support for multiple format variations.

The Solutions

All My Papers technology was used to solve both the data integrity and interoperability issue challenges for this type of solution.

The MICR Verify technology provided in the AmpLib SDK is used to automatically correct rejects and misreads in the MICR data captured, solving MICR data integrity problems.

The "Exchange Ready" functions provided in the AX9LIB SDK ensure images are captured in correct formats and without image quality issues.

The AX9LIB SDK provides the means to produce the required ICL formats required by the different financial institutions.

Using All My Papers toolkits, this customer is able to dedicate its scarce programming resources to the features of the application.

It does not have to concern itself with the intricacies of ICL processing because the toolkits already support the formats they need.

This enabled a quick time to market for its solution, giving it a superior competitive advantage over solution providers who try to implement their own ICL file processing technology.



Through this whitepaper, you now have a good understanding of the issues at hand before you take the next steps toward your own implementation. We would appreciate hearing from you if you have any questions or comments related to this whitepaper or about any of the All My Papers ICL processing products.

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We hope you will choose All My Papers technology for your implementation. We know you will appreciate how easy our tools are to use.

We are able to rapidly implement an efficient system that will isolate you from all the interoperability and data integrity problems that are out there, saving you time, aggravation, and money.

