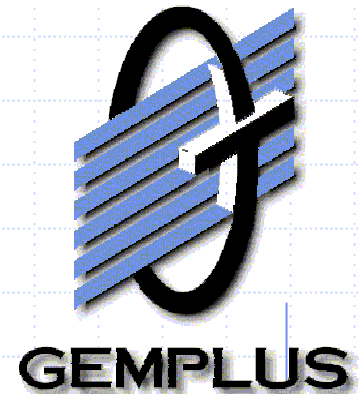


# Interoperability and Card Printing

A Joint Presentation from:

*Oberthur*  
Card Systems

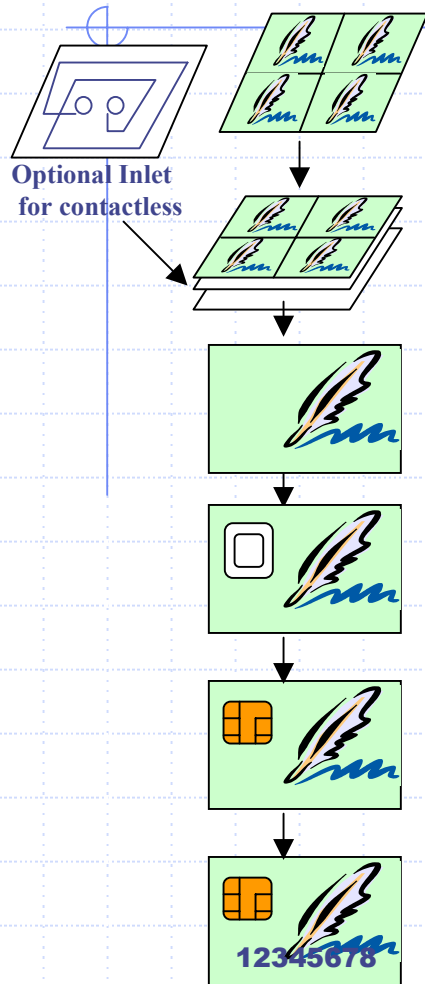


# Schlumberger

# Introduction

- ◆ Printing during card manufacture v.s. card issuance
- ◆ Typical causes of print problems during issuance
- ◆ ISO Standards and Interoperability
- ◆ General recommendations

# Old Fashion Manufacturing Process



## ◆ Printing

- Artwork is identical on all cards and printed on large sheets

## ◆ Lamination

- Card body is constructed using printed sheets on the outside layers
- Optional inlet with antenna and contactless chip

## ◆ Punching

- Individual cards are punched out of the lamination sheet

## ◆ Milling

- A cavity is drilled to accommodate the chip

## ◆ Embedding

- The smart card IC is plugged in

## ◆ Personalization

- Card number and name are embossed on the card

# Old Fashion Manufacturing Process

## **Pros**

- ◆ Process derived from Financial Card Industry
- ◆ Sheet Printing similar to publishing
- ◆ High quality print
- ◆ Full card surface
- ◆ Print rejects scrapped before IC added value
- ◆ Low cost for large volume

## **Cons**

- ◆ Visual personalization initially limited to embossable text

# Interoperability Issues

## ◆ Interoperability easily achieved on standard design

- Same artwork provided to all manufacturers
  - Standard films, disk etc...
- Color matching process at the proof approval level
  - Simple process on most artworks

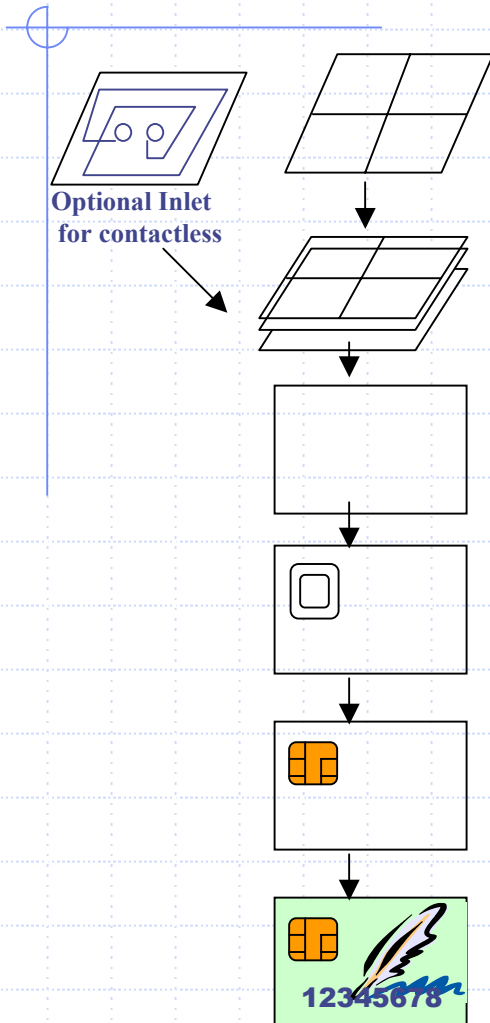
## ◆ Higher Skills required for visual security features:

- Rainbow Background
- Guilloche
- Microprint
- UV Printing
- Holographic Overlay

**No Real Interoperability Issues Between Major Card Manufacturers**

# ID Cards Manufacturing Process

(as seen for US Gov Programs)



- ◆ Plain White Card Bodies Manufacturing
  - Lamination with or without contactless inlet
  - Punching
  
- ◆ Smart IC embedding
  - Milling & Embedding
  
- ◆ Card issuance
  - Chip personalization with card holder information
  - Card Printing
    - ◆ Text (Name...)
    - ◆ Images (Logo, photo ID,...)
    - ◆ 2D & 3D bar codes
    - ◆ Color and B&W

# US ID Cards Manufacturing Process

## Pros

- ◆ Great Flexibility for multiple card designs

## Cons

- ◆ Lowest yield operation done after addition of the highest added value (IC)
  - high cost print rejects
- ◆ Scratches and dust highly visible on white background
  - Higher percentage of cosmetic rejects
- ◆ Cannot print directly on the back of the chip
  - Limit the possibilities for artwork
- ◆ Print Quality generally not as good
  - High sensitivity to card body characteristics
- ◆ Printer Compatibility
  - Results are printer dependent

# Typical Causes of Print Problems

- ◆ Card warpage or deformation
- ◆ Surface irregularities or dirt
- ◆ Surface plasticizer contamination
- ◆ Irregularities in thickness caused by chip or antenna embedding
- ◆ Printing too close to module
- ◆ Delamination issues
- ◆ Printer compatibility



# Interoperability Issues

- ◆ Print results highly sensitive to material differences
  - Printer settings need adjustments for optimal performances
    - ◆ Print head pressure
    - ◆ Temperature
    - ◆ ...
  
- ◆ Different Printers may achieve different results
  
- ◆ Final card colors/contrast may vary per grades of «White» from different suppliers

# ISO Compliance & Interoperability ?

- ◆ **ISO/IEC 7810:** Identification Cards - Physical characteristics
  - Specifies card body characteristics such as Dimensions, Flatness, Opacity, Bending Stiffness, Flammability, Toxicity, Resistance to chemicals, Card dimensional stability and warpage with temperature and humidity, delamination, etc
- ◆ **ISO/IEC 7816-1:** Physical characteristics
  - specifies the card's physical characteristics after the insertion of integrated circuit(s) with contacts into an ID-1 card type meeting the requirements of ISO/IEC 7810.
- ◆ **ISO/IEC 7816-2:** Dimensions and location of the contacts.
  - specifies the dimensions, locations and assignment for each of the contacts on integrated circuit(s) cards
- ◆ **ISO/IEC 7816-3:** Electronic signals and transmission protocols.
  - specifies the power and signal structures, transmission mechanisms and communication with the card.
- ◆ **ISO/IEC 10373** Part 1, 2, and 3
  - specify the test procedures used to check cards against the parameters specified in the above standards.

**ISO Standard has paved the way for interoperability,  
but did not address post embedding printing.**

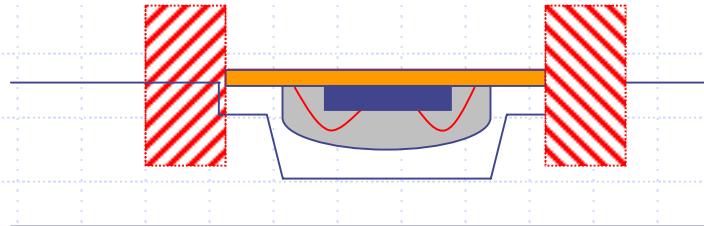
# Card Flatness (Warpage)

- ◆ According to ISO, the card warpage (or the height of the highest point on the card while the card lays on a flat surface) can be up to 0.060 inches or 1.5 mm (ISO/IEC 7810 - clause 8.1.11).
- ◆ Field returns show that the actual threshold of some desktop printers can be lower depending on the material used in the card structure

# Surface Profile of Contacts

- ◆ According to ISO, No point of the IC contact surface shall be higher than 0,05 mm above or lower than 0,1 mm below the adjacent surface of the card. (ISO/IEC 7816-10 - clause 4.2.3).
- ◆ In the same paragraph, ISO adds the following in bold:
- ◆ **WARNING For cards which are printed after embedding, problems may be encountered when contacts are above the adjacent surface of the card.**

Potential « tent effect » no printing zone



# Contacts Plate Dimensions

- ◆ ISO defines eight contacts ( C1 to C8), not the contact plate itself.
- ◆ Dimension, Shape, Geometry, Color etc are manufacturer dependant
- ◆ Some contact plates may end closer to where you want to print text

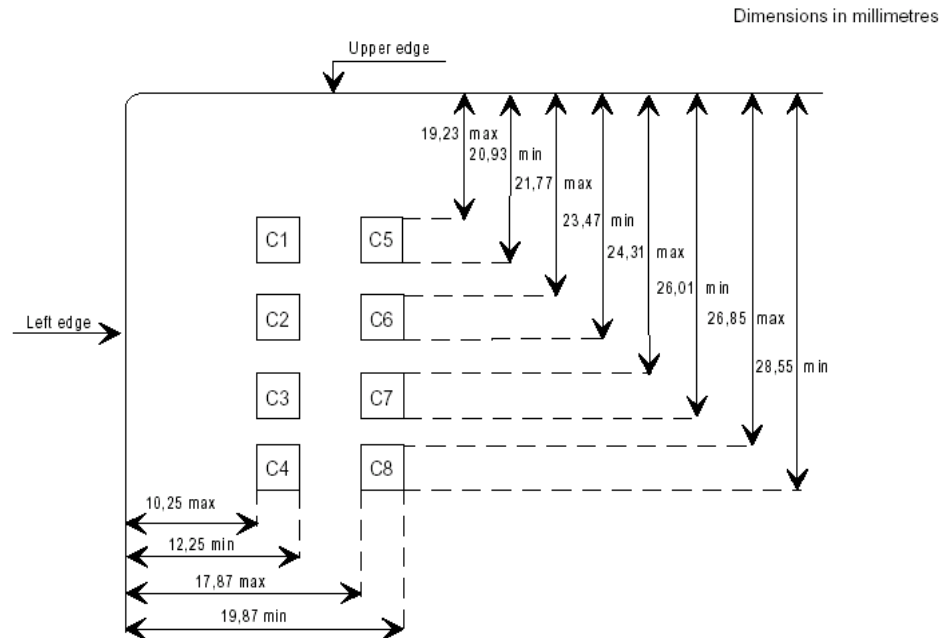
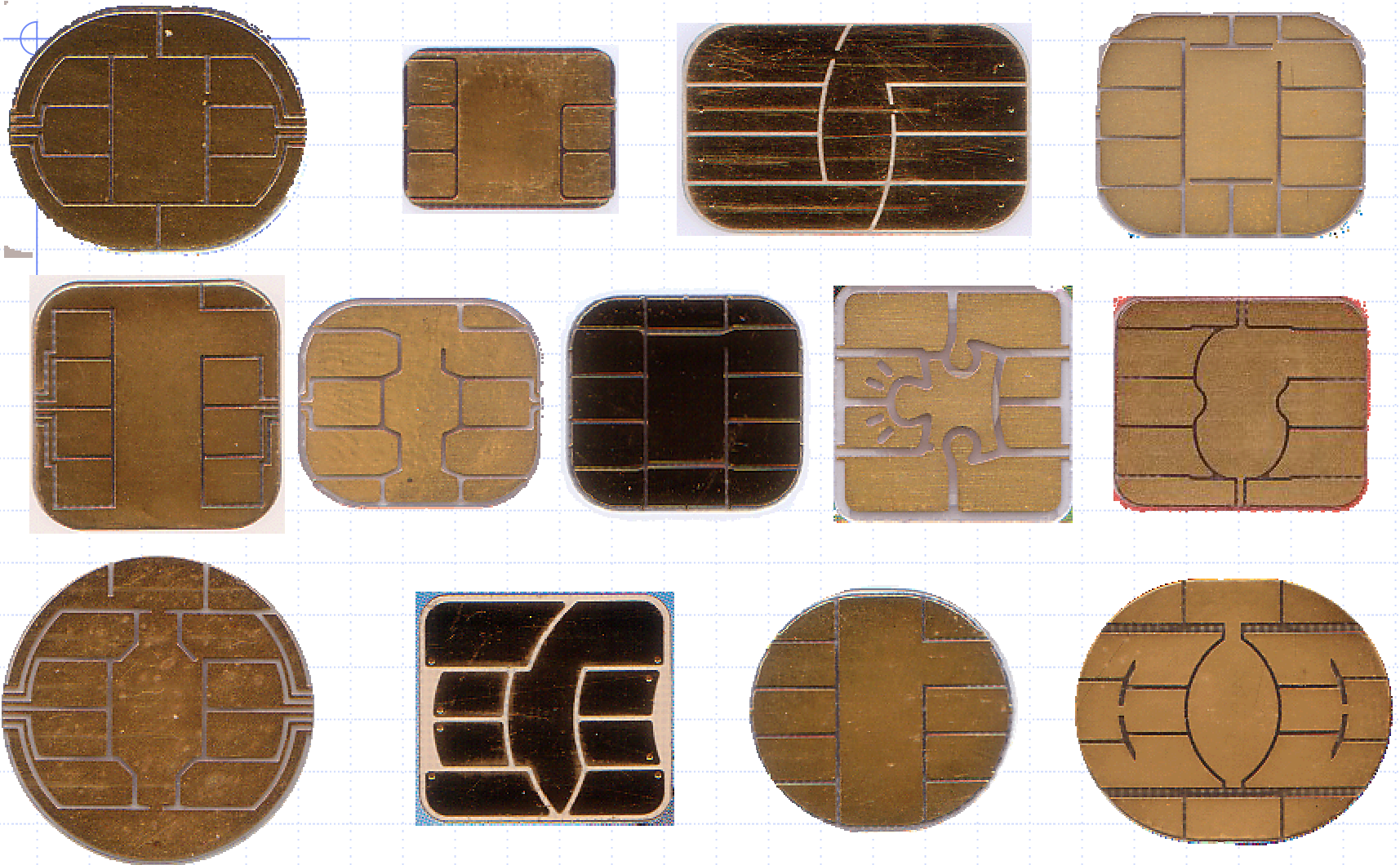
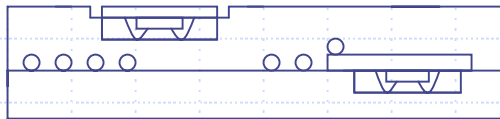
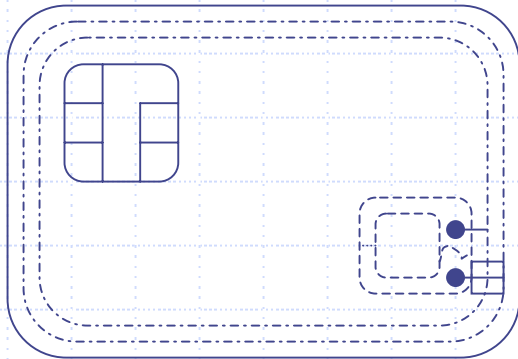


Figure 2 — Location of the contacts

# Contact Plates Samples



# Contactless Cards



## ◆ Pure Contactless

- single chip, contactless interface only

## ◆ Hybrid Cards

- 2 separate Chips
- No direct communication in between

## ◆ Dual Interface Cards

- A single chip with both contact and contactless interfaces
- Possibility to share memory resources between the two interfaces

# Interoperability Issues

- ◆ Potential problem when printing directly above:
  - the antenna
  - The contactless chip
  
- ◆ Location of contactless chip not standardized
  - Varies from manufacturers to manufacturers
  
- ◆ Multiple type of antennas
  - Size
  - Geometry
    - ◆ Square
    - ◆ Round
    - ◆ Oval
  - Thickness



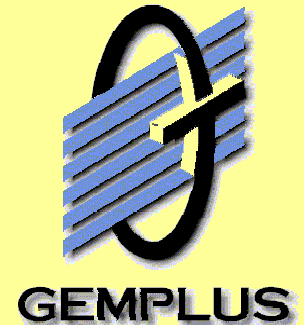
# Conclusions

- ◆ Involve card manufacturers in the early stage of your artwork design
  - We're here to help
- ◆ Get as much of your artwork printed by card manufacturers
  - Cardstock Inventory may be less costly than printing with high reject rate
- ◆ Don't try to fill all the blank
  - A hardly required information can skyrocket your cost
- ◆ Avoid having to print variable data/picture
  - Too close to the contact plate
  - Too close to the edge of the card
  - Above the contact chip on the back of the card
  - Above the contactless chip
  - Above the antenna (contactless cards)
- ◆ Minimize risk of card contamination before printing
  - Keep the boxes sealed until the cards are needed
  - Use lint free gloves to handle the cards
- ◆ Perform some tests with printers and cards from multiple suppliers
- ◆ Don't forget to clean your print heads!

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