



Intel® Pentium® 4  
Processor at 3.06 GHz  
Featuring Hyper-Threading Technology



## Bruco Integrated Circuits

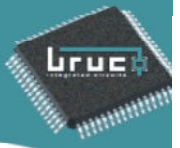
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Harry Diepenmaas  
Managing director

Corporate overview, jan 2001



❖ **Bruco is founded in 1988**

1st customer BMW / ELMOS.

❖ **25% resource growth per year**

Employing experienced resources



❖ **Development of more than 120 custom IC's**

35 Resources

32 experienced IC designers at bachelor's, master or PhD degree.

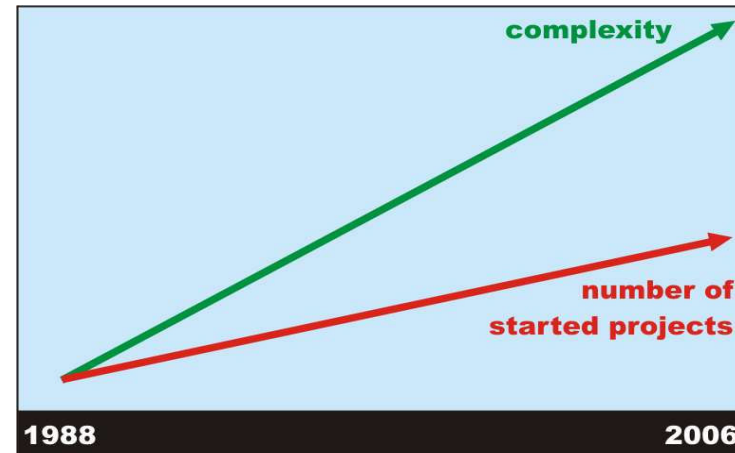
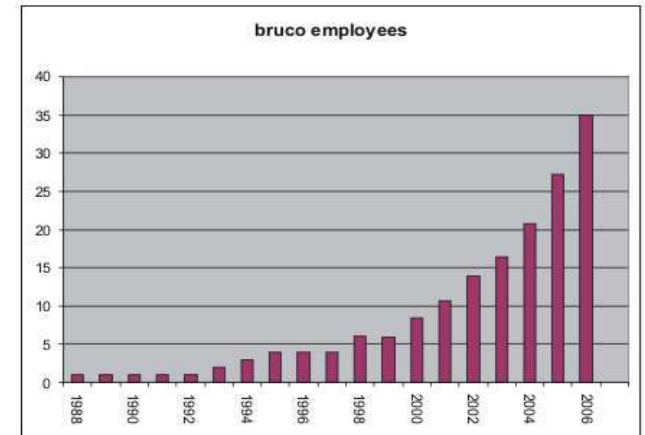
1/3 RF

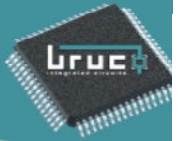
1/3 analog

1/3 digitaal

❖ **More than 350 man years experience**

❖ **Characteristics of developed IC's:**





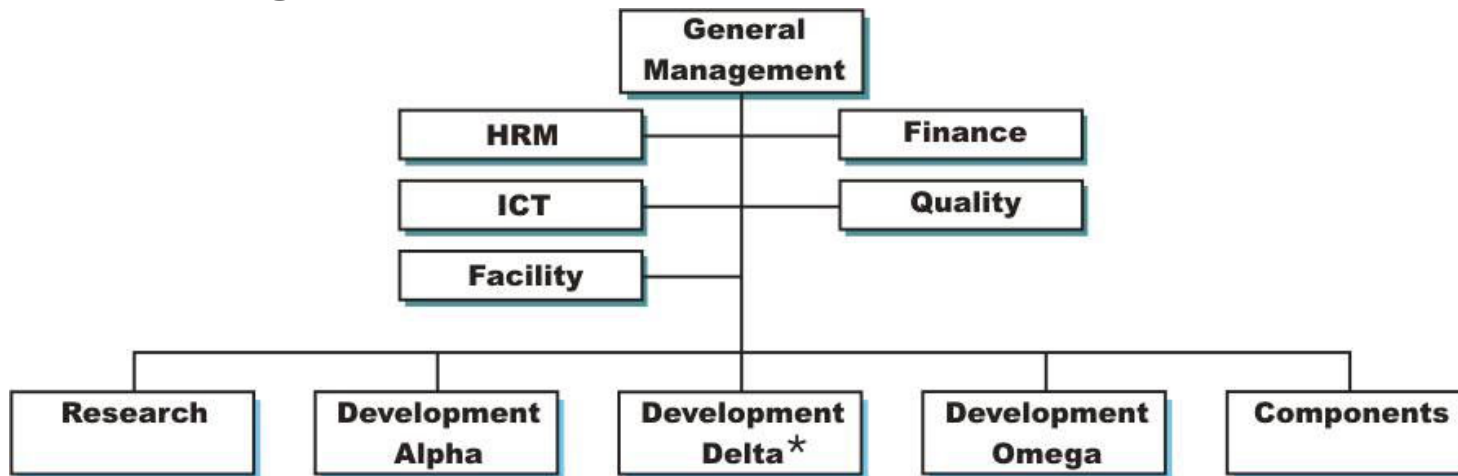
## **Bruco's mission:**

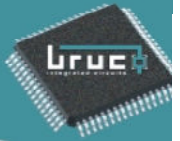
*To be recognized as the best in mixed signal IC creation and supply*

## **Bruco's 3 years objectives:**

- *Diversification in customers and markets*
- *Enhance knowledge base*
- *Sell more customer specific IC's*

## **Organizational diagram:**





## ***The company Bruco employs three activities:***

- ***Integrated Circuits*** offers *development service* on design, verification, test and qualification of Application Specific Integrated Circuits (ASIC).
- ***Components*** offers *logistic service* on wafer manufacturing, assembly and test **and** *storage service* for wafers and products.
- ***Research*** focuses on *Wireless Measurement and Diagnostics*

## ***Business model:***

### **Project:**

Able to jump into a project in every phase  
Projects entirely in-house versus cooperation with customer

### **Financial:**

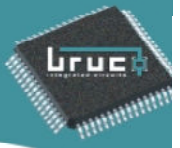
Financial model is uniform hourly rated based, monthly invoice, excluding tool licenses  
Customer can stop project any time without financial consequences

### **IP:**

Bruco IP and idea's will be made available for customer  
Customer IP will remain unaffected

### **Warranty:**

IC creation and supply: "AS IS" and "Ex works"



*Bruco's partners and customers:*

**PHILIPS**

**NXP**  
founded by Philips

**Carsem**  
Your Technology Partner

**DAIMLERCHRYSLER**



**ELMOS**

**PIERBURG**

**nedap**

**océ**

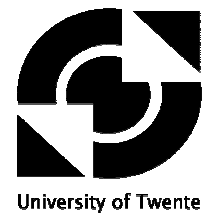
**agere** systems



**ASML**

**vitatron**

**DELPHI**  
Automotive Systems



**EUROPRACTICE**  
ASIC SERVICE

**DELPHI**  
DISPLAY SYSTEMS

**BOSCH**

**PEMSTAR**

**SE** Salland  
Engineering

**MICRONAS**

**KU**  
**LEUVEN**

**BOFORS**  
DEFENCE

**hechinger**  
GmbH + Co. KG

**ERICSSON**

**FLUKE**

**PANalytical**



## Automotive

- High voltage and smart power
- Motor drivers, waterpump
- LIN, SPI, CAN
- Airbag, cruise control, immobilizer



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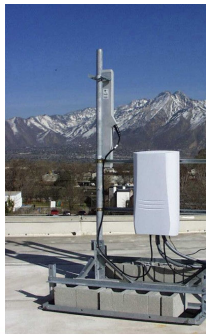
## Power management

- Battery control
- Power MOS FET drivers
- Low drop output regulator
- SMPS, current mode control



## Mobile communication/Telecom

- Radio: DECT, UMTS, WLAN, Bluetooth
- Base band: DECT, WLAN
- DSP (OFDM)
- Active RFID



## Test and measurement

- Oscilloscopes and multi-meters
- HF amplifiers
- High speed sampling
- P2CCD time conversion system



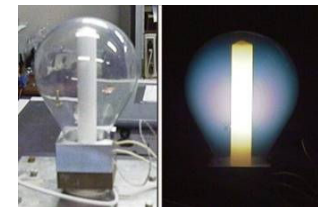
## Medical

- Low power pacemaker



## Lighting

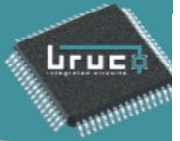
- QL Lamp driver



## Miscellaneous

- Project management
- Research, development and logistics
- IC technology, tools and modeling
- FPGA
- uProcessor
- Digital library development
- Filters: FIR, IIR
- Coding: Manchester, Viterby





# Technology:

**Bruco has access to all Elmos and Philips technologies**

## Philips

- SOI, ABCD processes
- Multi die packaging
- Cmos 18 – Cmos 065
- High voltage
- BiCmos and SiGe

## Elmos

- SOI, 0.5um HVCMOS processes
- Sensor on chip technology, MEMS

## Philips

C100/75/50	0.5/0.35/0.25µm, 3.3V,
CMOS18	0.18µm, 1.8V/3.3V dual oxide CMOS with flash option
CMOS12	0.12µm, 1.2V/3.3V dual oxide CMOS
CMOS090	0.09µm, 1.2V/3.3V dual oxide CMOS
Bimos1.5	2.5µm CMOS, 3GHz NPN
Qubic4s	70GHz NPN, SiGe BiCMOS
HVDMOS	700V BiCMOS
A-BCD2	1.6µm, 60V, HV SOI BiCMOS
A-BCD3	1.0µm, 120V, HV SOI BiCMOS
Robot1&2	350MHz, bipolar

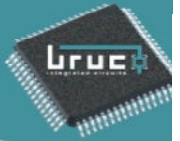
## Elmos

	<b>with Flash, E2PROM, 10A DiMOS and MEMS</b>
HVCMOS	1.2µm, 120V, BiCMOS
HVCMOS	0.8µm, 120V, dual oxide BiCMOS
HVCMOS	0.5µm, 120V, dual oxide BiCMOS
SOI	1.2µm, 300V, BiCMOS
SOI	0.8µm, 120V, dual oxide BiCMOS
SOI	0.5µm, 120V, dual oxide BiCMOS

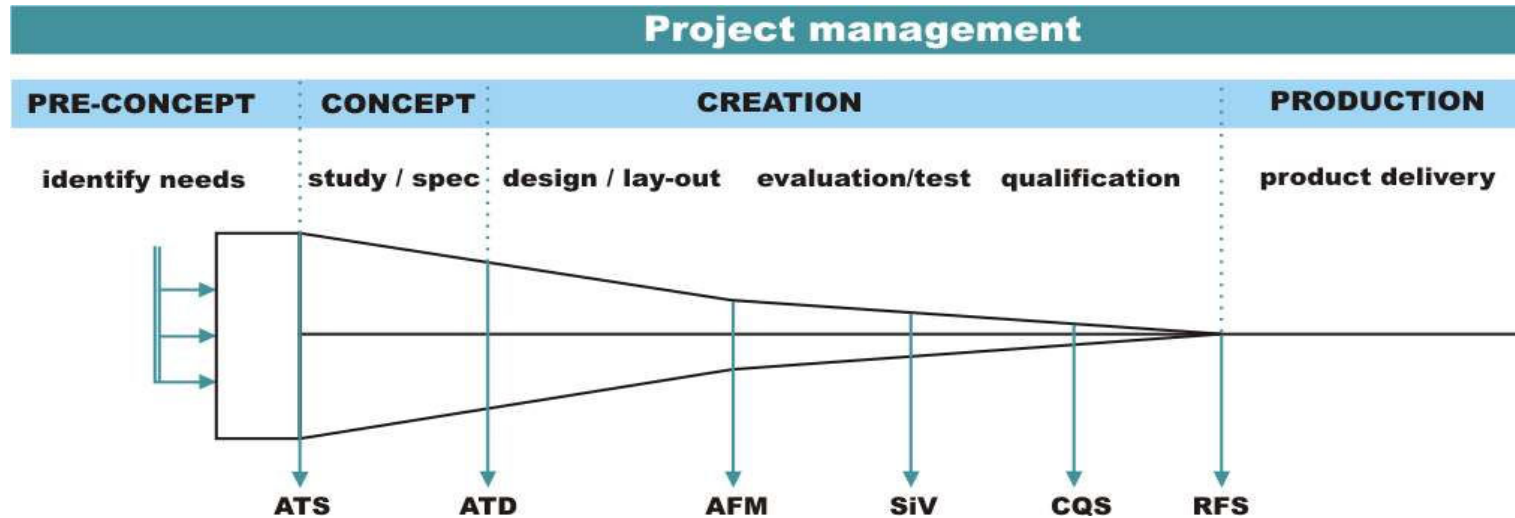
**Commercial available processes: Europractice flow**

**All commercial available processes can be handled within the Bruco organization**

**FPGA: Altera / Xilinx**



## IC creation process and supply



ATS=Acceptance Type Study

ATD=Acceptance Type Development

AFM=Acceptance For Mask making

SiV= Silicon Verified

CQS=Customer Qualification Samples

RFS=Release For Supply

Think before you act with respect to

- Costs
- Schedule
- Performance

*First time “functional” right approach*

## Design/layout

- **Specification and design**

Use preferred tools of foundry.

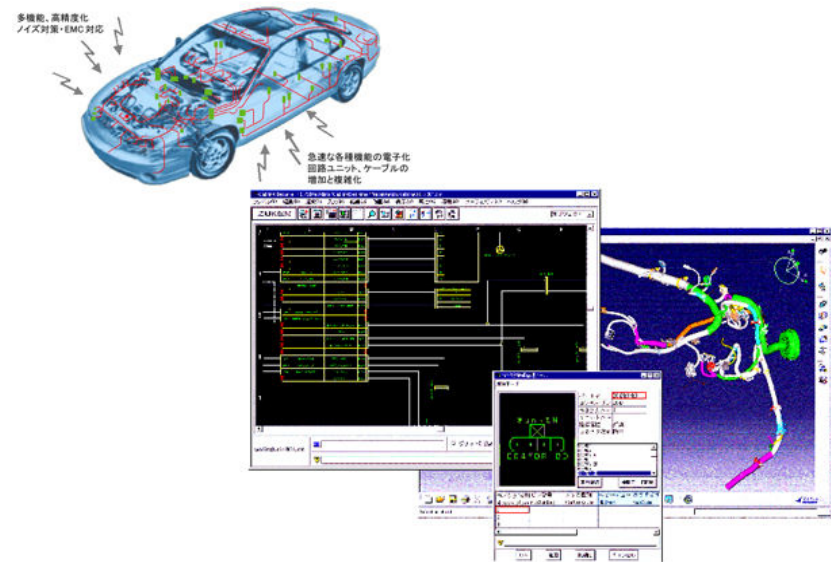
Broad experience on different tool flows

Mentor

Cadence

Synopsys

Orcad/PSpice/ICED



## Evaluation/Test

- **Evaluation**

Automated evaluation environment with Agilent equipment

Fully PC controlled

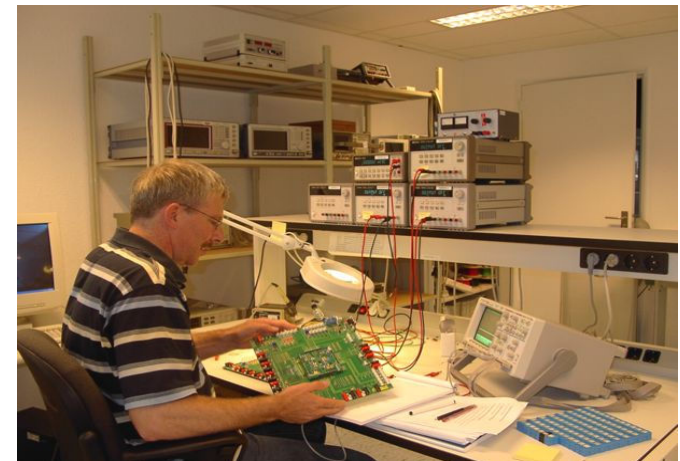
Own SW modules for fast verification and test

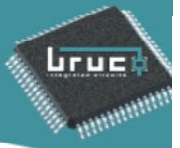
- **Test**

Test engineers from Salland Engineering

At foundry specific tester

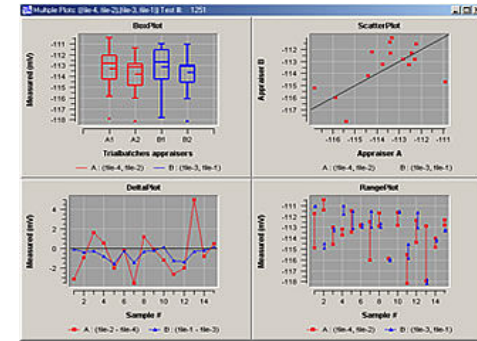
At Delta on Teradyne/Agilent





# Qualification

- **ESD testing**
  - Human body model
  - Machine model
- **HTOL testing**
  - According Jedec standards
- **Statistical analyses with Sedana**

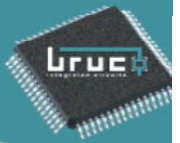


# Production and Supply

- **We take care for the whole supply chain**
  - Forecast
  - Packaging
  - Testing
  - Packing
  - Shipment to customer
- **Storage facilities for wafers and/or components in a Nitrogen environment**
- **For safety reasons Bruco has two separated sites for storage**



*Zero defect delivery*



# Research

## **Why**

To increase the know-how  
in our IC creation and  
its exposure to the R&D community.

## **Program**

*Based on Wireless Measurement and Diagnostics*

## **Projects**

SPAN: One chip spectrum analyzer together with University of Twente

FAME transponder:

Technology transfer

Asynchronous design with tools from Handshake Solutions

MEMSland

Bluetooth transmitter imperfections publication for University of Alberta

## **Support**

Technical support from the IC design group of Professor B. Nauta (University of Twente)

Innovation is financially supported by the government

Bruco is willing to invest in long term customer-relationships