

Manufacturer-neutral Training in Coordinate Metrology

Manufacturer-neutral Training in Co-ordinate Metrology (AUKOM)

Hochschule Aalen

HAW

RENISHAW
apply innovation™

BFW GOSLAR

WENZEL®

Messtechnik
Wetzlar GmbH

UNIMETRIK S.A.

FARO

werth
Messtechnik

Mahr

DAIMLER

MTU
Aero Engines

HEIDELBERG

Mitutoyo

VW

ZEISS

FQS

HEXAGON
METROLOGY

Staatliche Technikerschule
Weilburg
Fachschule für Technik

HESSEN

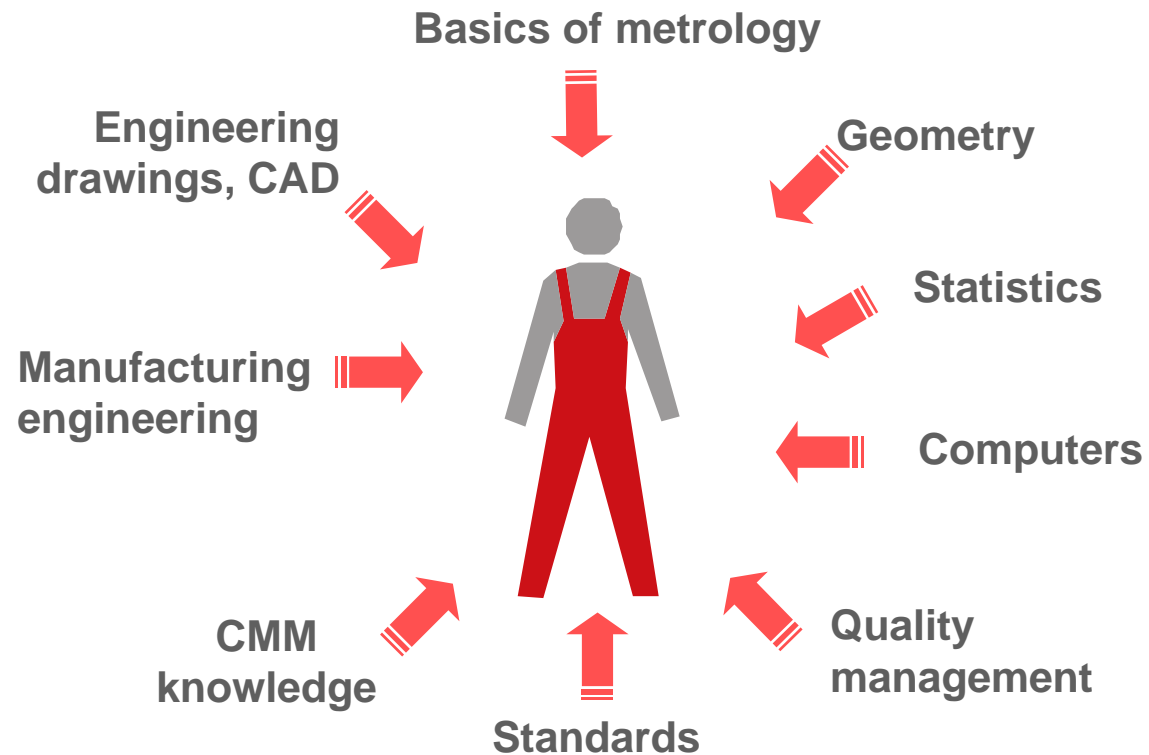
gp Messtechnik GmbH

Technische Fachhochschule Wildau
University of Applied Sciences

ATEH

- AUKOM Concept
- Necessary Knowledge
- Training Necessity
- Current Deficits
- Aims of AUKOM
- AUKOM Structure
- Umbrella Organisation

Necessary Knowledge of the Operators of Coordinate Measuring Machines (CMM's)



- AUKOM Concept
- Necessary Knowledge
- Training Necessity
- Current Deficits
- Aims of AUKOM
- AUKOM Structure
- Umbrella Organisation

Necessity for a Well-Suited and Global Training in Coordinate Metrology

- **Secure, comparable and reproducible measurement results**
- **Results with small measurement uncertainty**
- **Increase of efficiency**
- **More effective use of CMM's**
- **Avoidance of errors**
- **Continuous quality improvement**
- **Reducing quality costs**



AUKOM Concept

Necessary Knowledge

Training Necessity

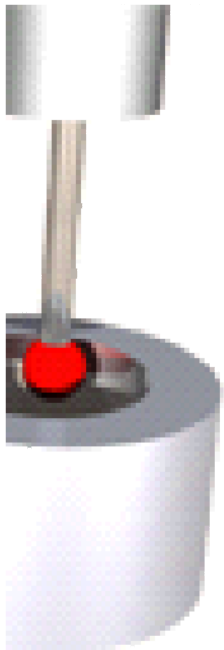
Current Deficits

Aims of AUKOM

AUKOM Structure

Umbrella Organisation

Deficits in Current Training Courses for Coordinate Metrology



- **too little metrology basics**
- **only few mathematical and physical basics**
- **too little knowledge of standards**
- **no standardized measuring strategies**
- **no comparable training concepts available**
- **user-dependent measurement results**

AUKOM Concept

Necessary Knowledge

Training Necessity

Current Deficits

Aims of AUKOM

AUKOM Structure

Umbrella Organisation

Aims of AUKOM – Global Training Standard

- ✓ Providing a training concept for CMM operators
- ✓ with device-neutral basics for analysis, planning and execution of measurement tasks and analysis of data (good coordinate measurement practice)
- ✓ with interfaces to machine-specific CMM software training
- ✓ with independent final exams and generally accepted certificates



AUKOM Concept

Necessary Knowledge

Training Necessity

Current Deficits

Aims of AUKOM

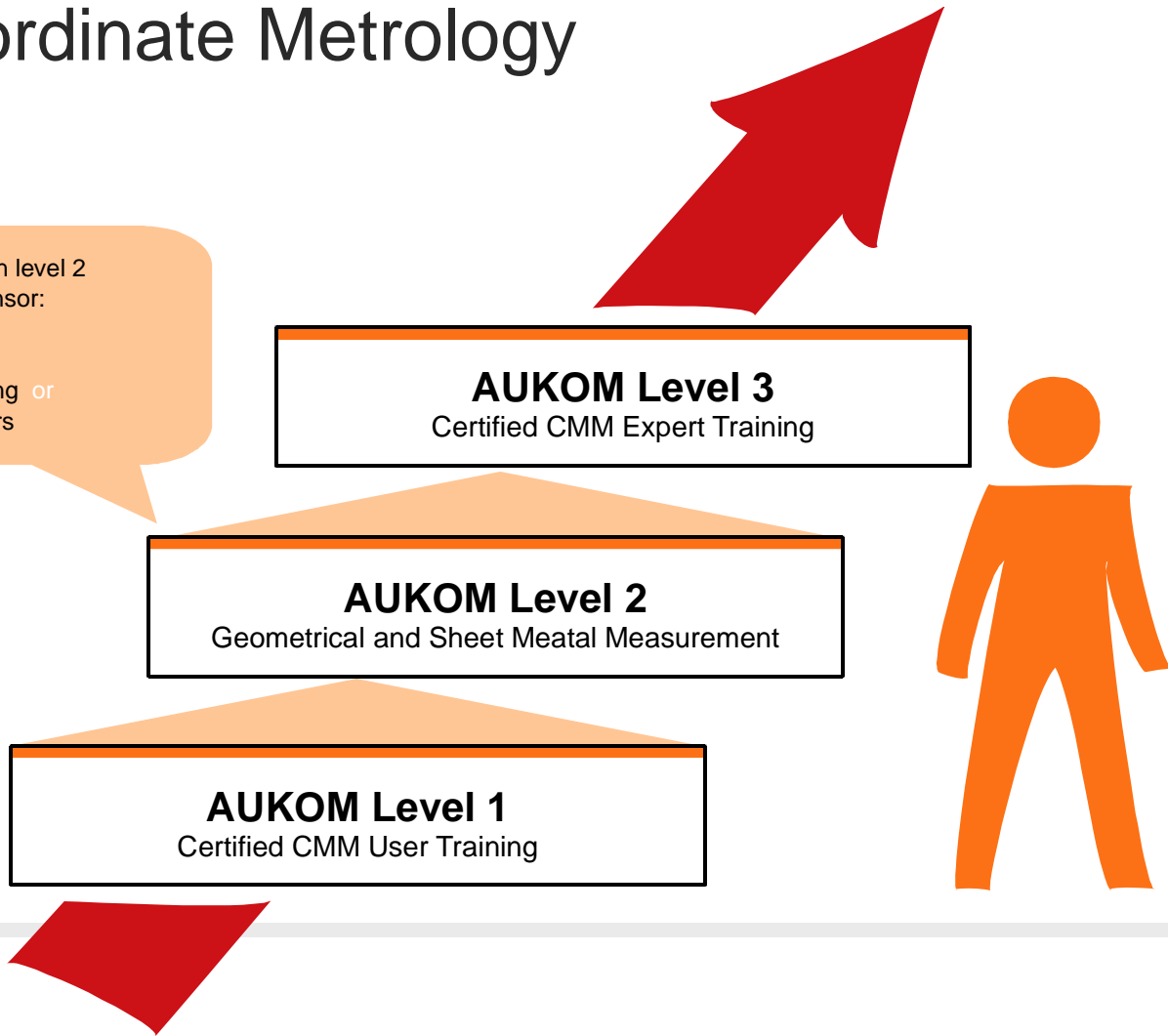
AUKOM Structure

Umbrella Organisation

Structure of Training Concept for Coordinate Metrology

Alternative focus in level 2
dependent on sensor:

- ▶ Tactile sensors
- ▶ image processing or
- ▶ Distance sensors



- AUKOM Concept
- Necessary Knowledge
- Training Necessity
- Current Deficits
- Aims of AUKOM
- AUKOM Structure
- Umbrella Organisation

Contents of AUKOM Level 1

Course and test: 8 days for newcomer CMM

Course and test: 4 days for skilled people

alternatively: E-Learning-system on a CD, only test



- **Units, lengths and angle**
- **Coordinate systems**
- **Geometric features (overview)**
- **Terms and definitions**
- **Configuration and design of CMM's**
- **Fixturing, soaking ... of the part**
- **Selecting stylus systems and optical sensors**
- **Performing and evaluating measurements, statistics**
- **Accuracy, measuring uncertainty**
- **Fundamentals in quality management methods**

AUKOM Concept

Necessary Knowledge

Training Necessity

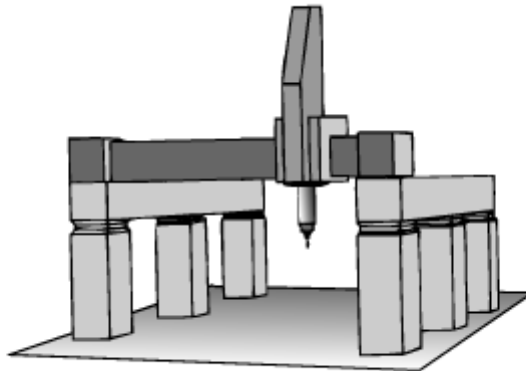
Current Deficits

Aims of AUKOM

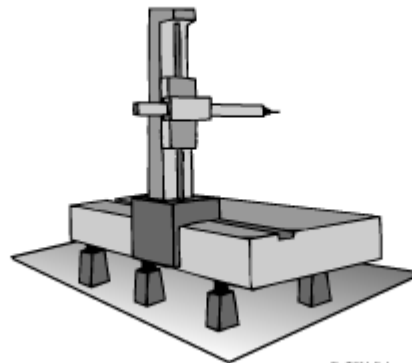
AUKOM Structure

Umbrella Organisation

AUKOM Level 1 Example for animation



© QFM Erlangen 2000



© QFM Erlangen 2000

- AUKOM Concept
- Necessary Knowledge
- Training Necessity
- Current Deficits
- Aims of AUKOM
- AUKOM Structure
- Umbrella Organisation

Contents of AUKOM Level 2

Course and Test: 5 days

Prerequisite: AUKOM Level 1 Test Passed

- Geometric features
- Geometrical tolerancing
- Measuring/probing strategy
- CNC-Programming
- Measurement of free form surfaces
- Evaluation, documentation
- Sources of uncertainty
- Monitoring of test equipment
- Statistical characteristics

AUKOM Concept

Necessary Knowledge

Training Necessity

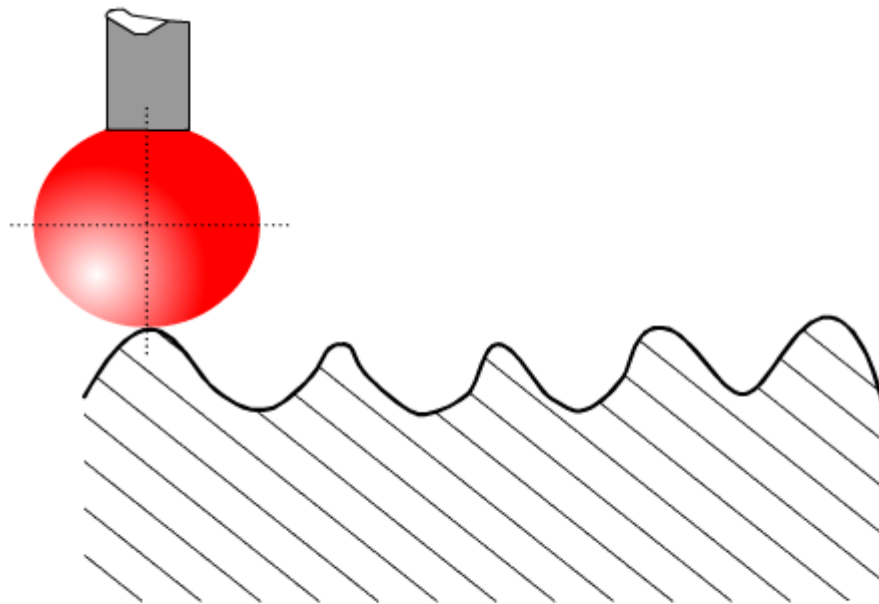
Current Deficits

Aims of AUKOM

AUKOM Structure

Umbrella Organisation

AUKOM Level 2 Example for animation



AUKOM Concept

Necessary Knowledge

Training Necessity

Current Deficits

Aims of AUKOM

AUKOM Structure

Umbrella Organisation

Contents of AUKOM Level 3

Course and Test: 5 days fundamentals and 3 days tolerancing

Prerequisite: AUKOM Level 2 or 2F passed

- **Basic block:**
 - Calculation of angles, distances ...
 - Fundamentals of production engineering
 - CAD, CAD-interfaces, digitization
 - Optimization of CNC programs
 - Quality management, user qualification, quality costs
 - Determination of measurement uncertainty
 - Filtering
- **Geometrical tolerancing for experts**

AUKOM Concept

Necessary Knowledge

Training Necessity

Current Deficits

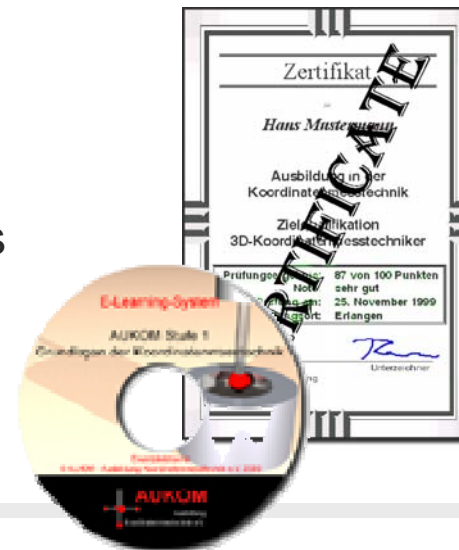
Aims of AUKOM

AUKOM Structure

Umbrella Organisation

Aims and Functions of the AUKOM organisation

- ▶ Developing, maintaining and updating a comparable, examinable and provable up-to-date training concept in coordinate metrology
- ▶ Promoting Good Coordinate Measurement Practice
- ▶ Qualifying trainers
- ▶ Awarding certificates
- ▶ Preparing and updating training documents
- ▶ maintaining the e-learning-system for AUKOM level 1



AUKOM Concept

Necessary Knowledge

Training Necessity

Current Deficits

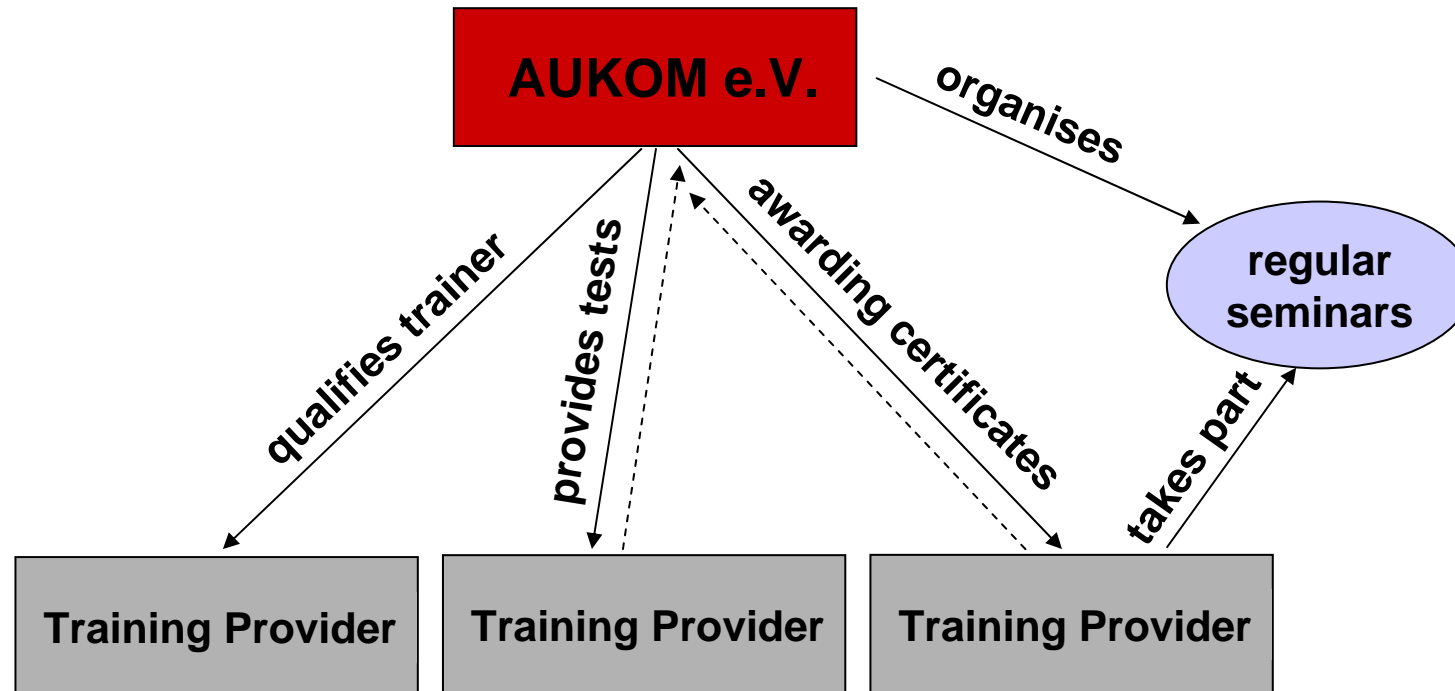
Aims of AUKOM

AUKOM Structure

Umbrella Organisation

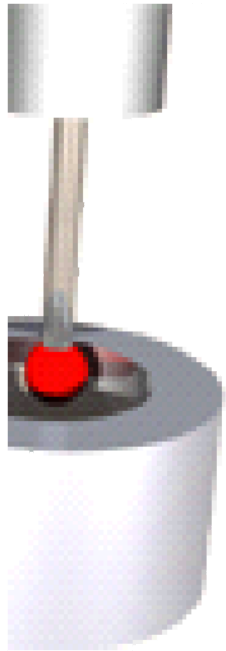
Global Training Standard

Aims and Functions of the AUKOM organisation



- AUKOM Concept
- Necessary Knowledge
- Training Necessity
- Current Deficits
- Aims of AUKOM
- AUKOM Structure
- Umbrella Organisation

Conclusion/Outlook



Coordinate metrology is a complex technology!

- **The operator of a CMM has an crucial influence on measurement results**
- **Hence, there is a strong need for training of CMM operators**
- **AUKOM is a training tool for providing a manufacturer-independent training in coordinate metrology**
- **AUKOM will contribute to more reliable measuring results and finally to better product quality**

AUKOM Concept

Necessary Knowledge

Training Necessity

Current Deficits

Aims of AUKOM

AUKOM Structure

Umbrella Organisation