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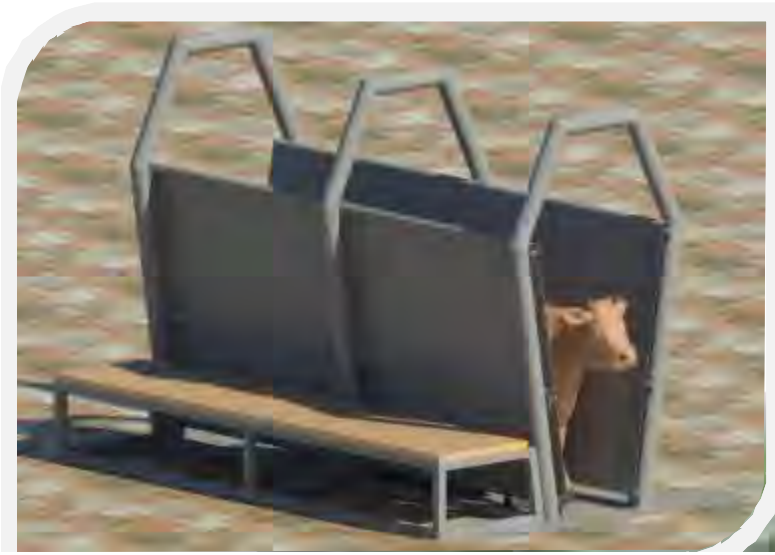
SAIAE CPD Event
28-30 September 2010

Virtual Reality Design Approach for Agricultural Projects Development

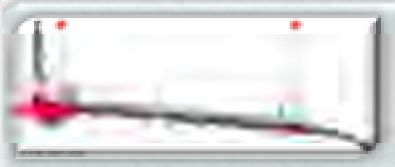


PRESENTATION OUTLINE

The ARC-IAE Family Tree

Developed Standard Design Procedure

Virtual Reality and Virtual Prototyping



Visualization and Virtual Reality in Ag Eng

Outputs and Discussions

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THE ARC-IAE FAMILY TREE

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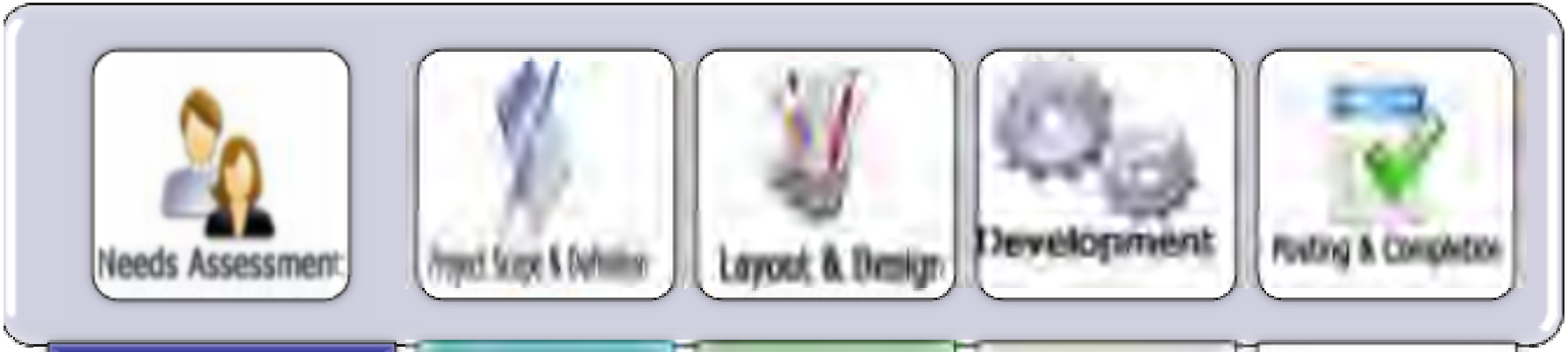
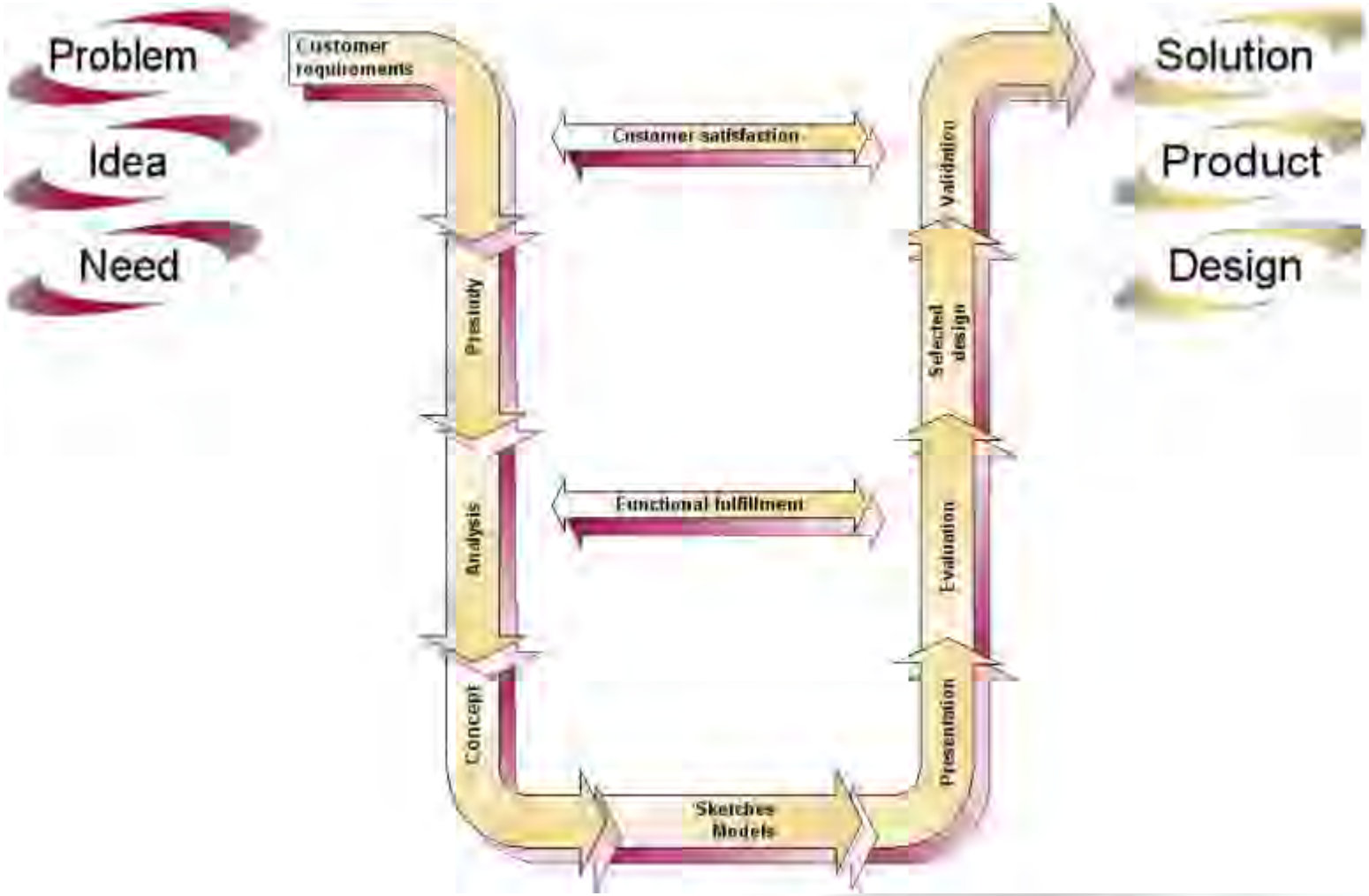
STANDARD ENGINEERING DESIGN PROCESS

Client Requirement → Pre study → Analysis → Concept Creation → Sketches and Modelling → Selected Design & Validation



Reconnaissance Surveys and Preliminary Investigation	**Detailed Project Planning**	**Toppo & Cadastral Surveys**	**Detailed Design , Drafting and Modelling**	**Simulation, and Prototype Creation & Installs**

STANDARD ENGINEERING DESIGN PROCESS cont



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VIRTUAL REALITY AND VIRTUAL PROTOTYPING

Virtual Prototyping

(also called systems performance modelling)

Refers to the design, simulation, and testing of new ideas, concepts, products, schemes, or processes in a synthetic but interactive computer environment

Purpose:

Virtual prototyping offers enhanced product innovation

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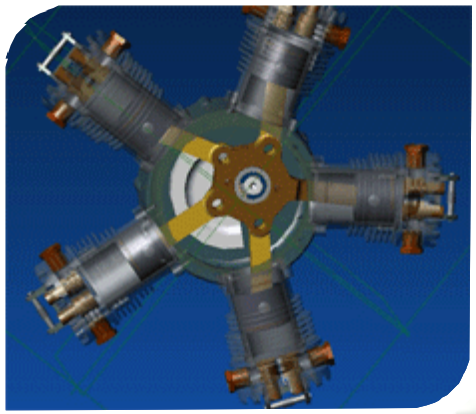
VIRTUAL REALITY EXAMPLE



VISUALISATION AND VR IN FARM STRUCTURES ENGINEERING

Engineering Team Intro:

Tendai Justin Mutenje

Agricultural Engineer

ARC –IAE Silverton

DIVISION:

Agricultural Infrastructures & Engineering Structures

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VISUALISATION AND VR IN FARM STRUCTURES ENGINEERING cont

Virtual Prototype of a Box Shaped Cattle Crush

RFID Controlled Cattle System

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VISUALISATION AND VR IN FARM STRUCTURES ENGINEERING cont

Constructed Box Shaped Crash Assembly

Blouberg 500 cattle feedlot

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VISUALISATION AND VR IN FARM STRUCTURES ENGINEERING cont

Virtual Model of a Feedlot Cattle Veterinary Facility

Venda 500 Cattle Feedlot

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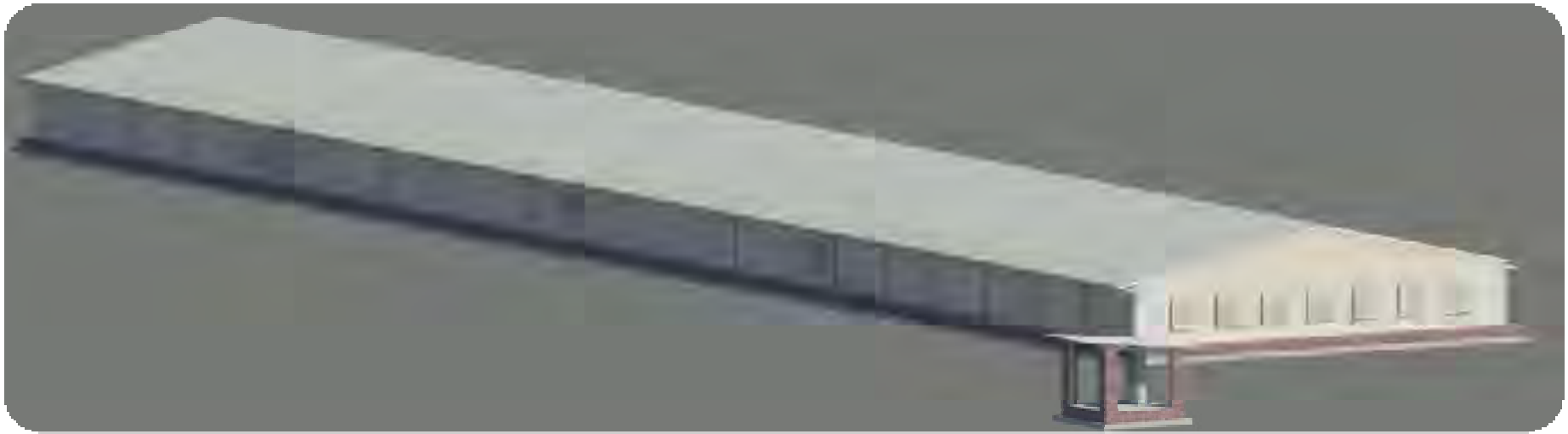
VISUALISATION AND VR IN FARM STRUCTURES ENGINEERING cont



Virtual Project of 35000 Broiler Unit ECDA

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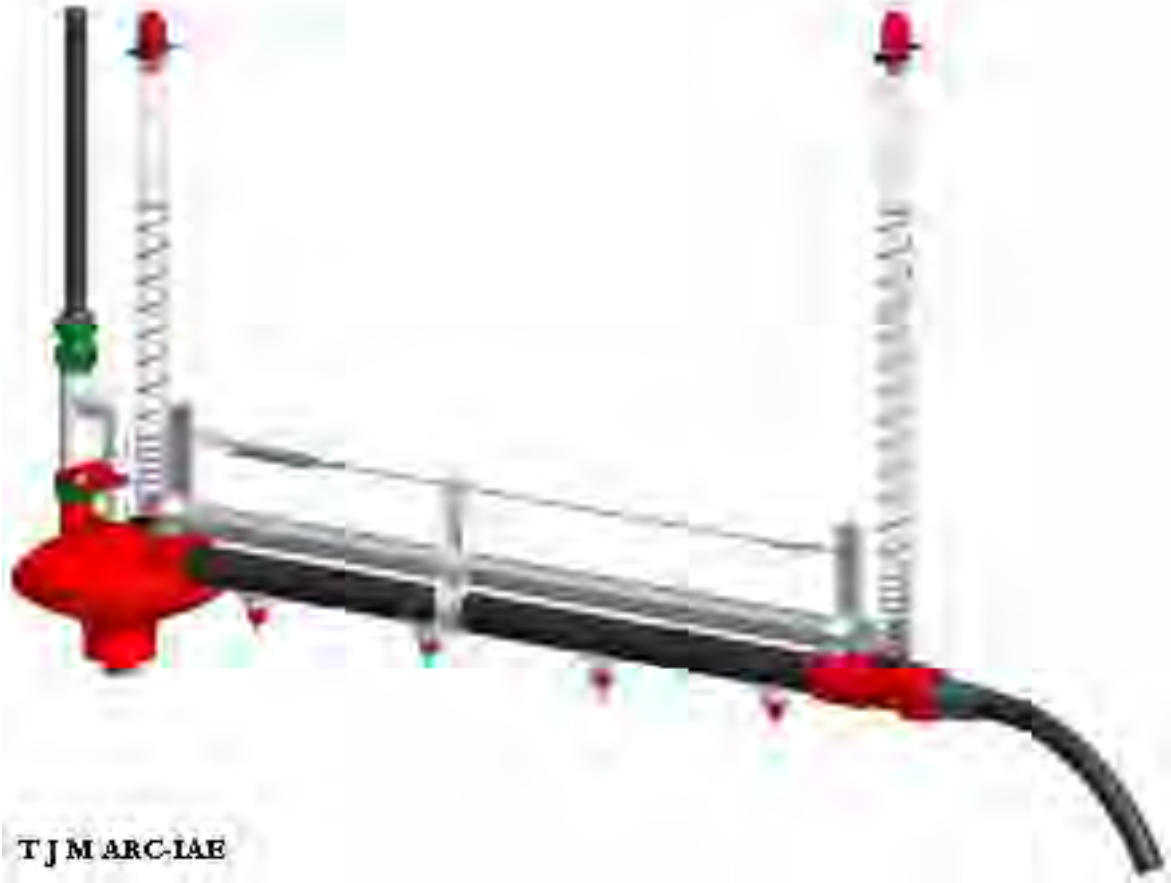
VISUALISATION AND VR IN FARM STRUCTURES ENGINEERING cont



Virtual Prototype of the Broilers Water Supply Line

ECDA 35000 Broiler Unit

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VISUALISATION AND VR IN FARM STRUCTURES ENGINEERING cont

Virtual Project elevated 300 goat infrastructure

ECDA goat Project

VISUALISATION AND VR IN AGRICULTURAL MECHANISATION

Engineering Team Intro:

Thabo Mavundza

Agricultural Engineer

ARC –IAE Silverton

DIVISION:

Agricultural Mechanisation & Automation

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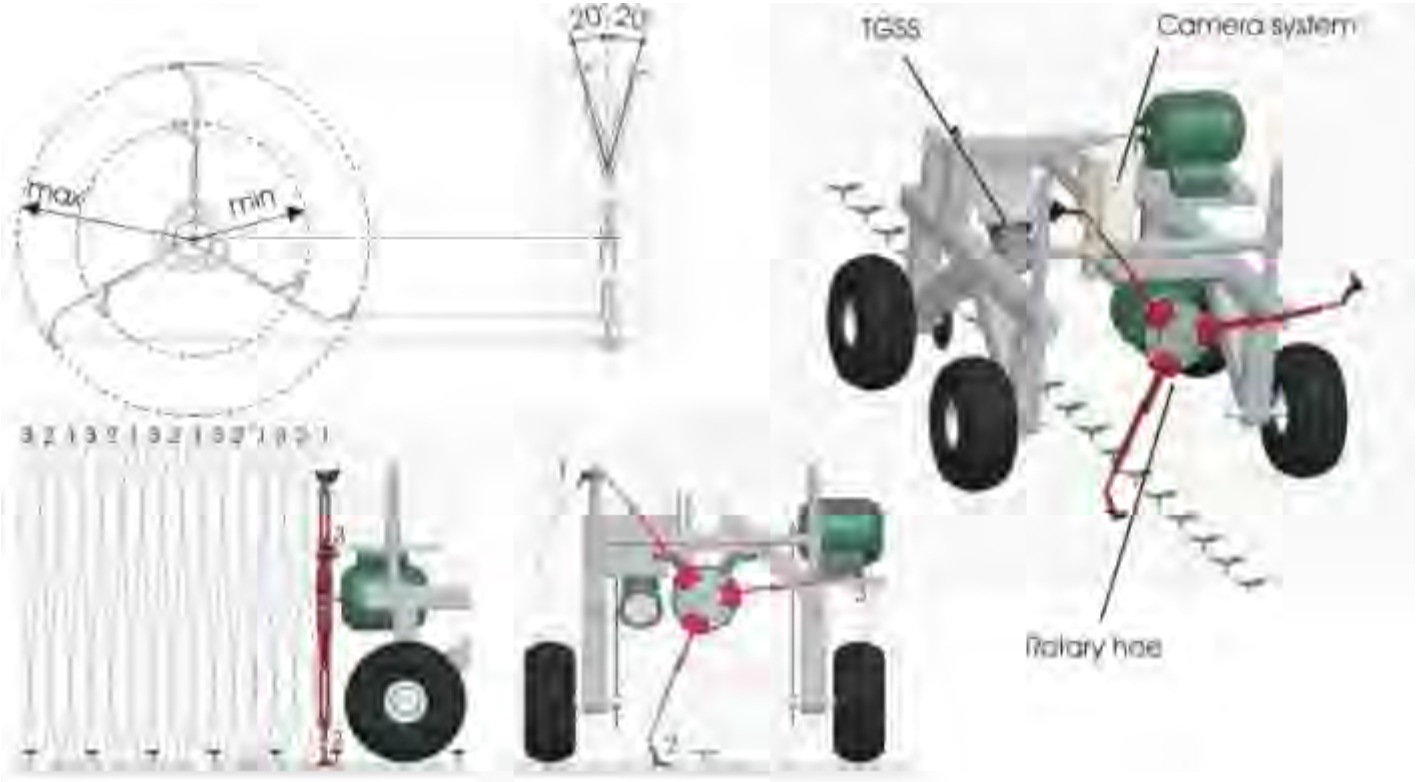
VISUALISATION AND VR IN AGRICULTURAL MECHANISATION cont



Use of Information Technologies for Precision Crop Protection

Optimisation of mechanical weeding in row crops by cross row hoeing

Main objective of this research was:

Development of an optimal weeding tool for mechanical weed control of the intra-row area in row crops, which could be adapted to different crop species, different plant intra-row distances and plant growth stages. The path from idea to the first prototype was significantly shortened by use of integrated mechanism design and simulations. Considering demands and constrains, a virtual prototype of the rotary hoe for intra-row weed control was designed

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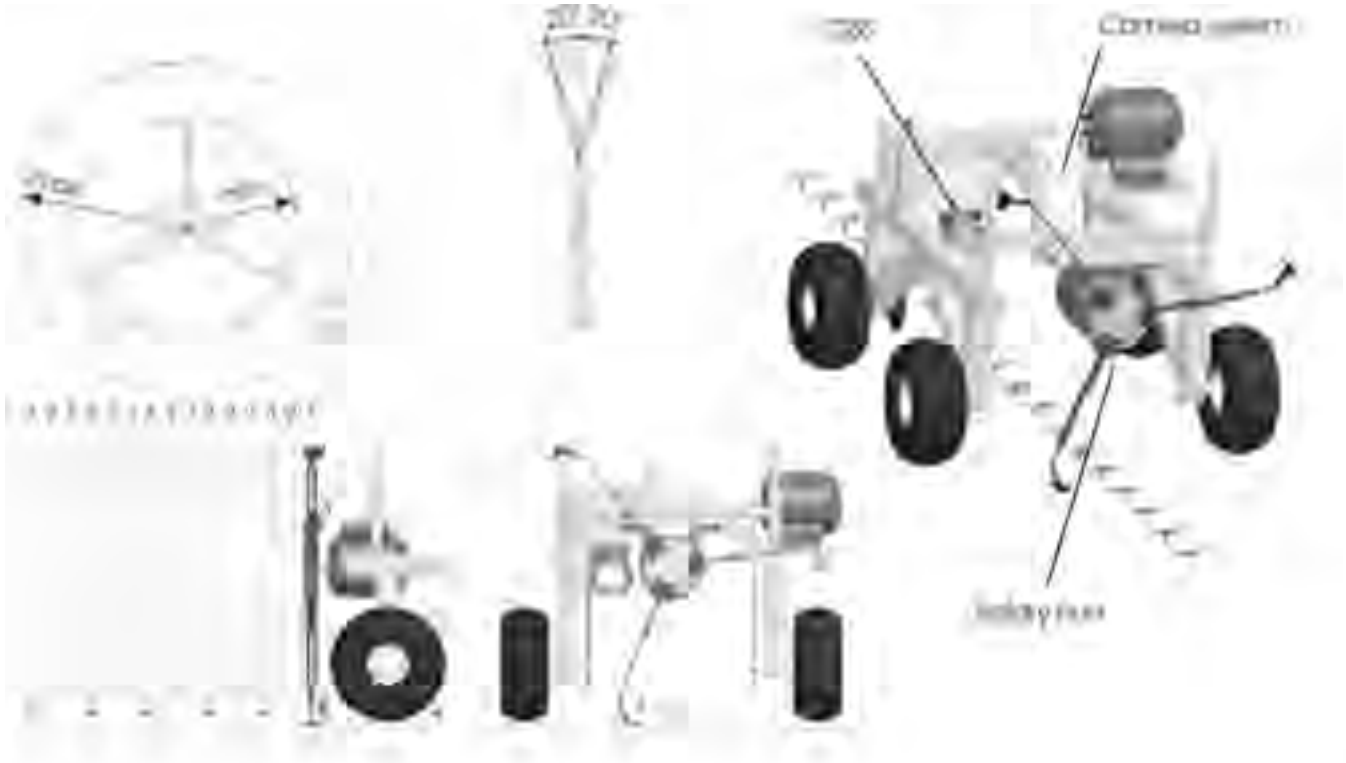
VISUALISATION AND VR IN AGRICULTURAL MECHANISATION cont



Kinematical behaviour of the hoes virtual prototype was simulated in order to optimise the hoeing process and trajectories of duckfoots under the soil surface in the intra-row area. After the comprehensive analysis of results observed with the virtual prototype the first physical prototype is built. Experimental tests and optimisation of the real-time control of the system are underway.

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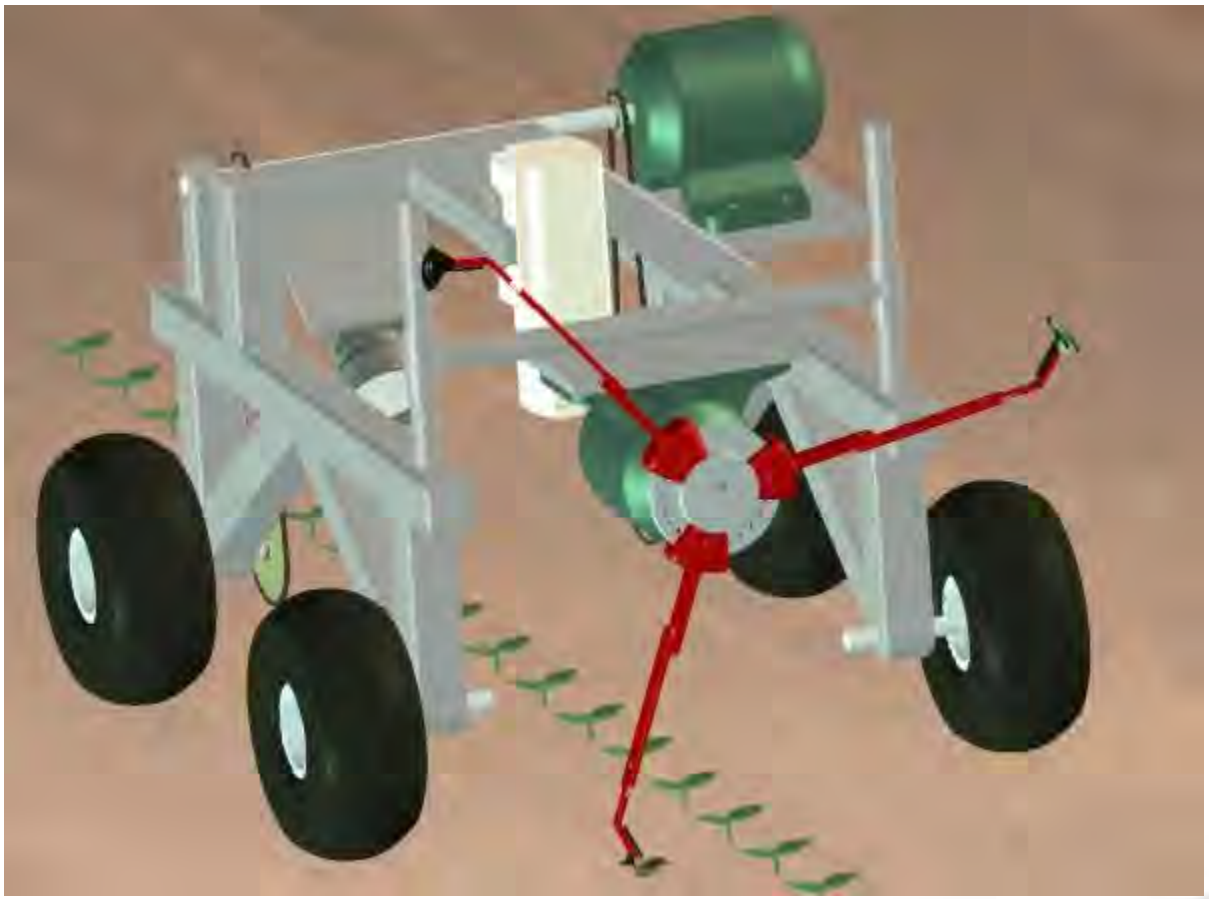
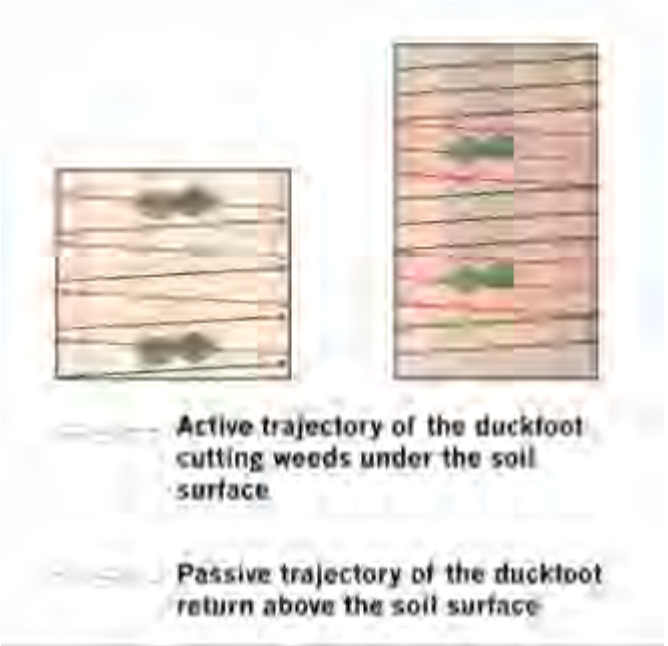
VISUALISATION AND VR IN AGRICULTURAL MECHANISATION cont





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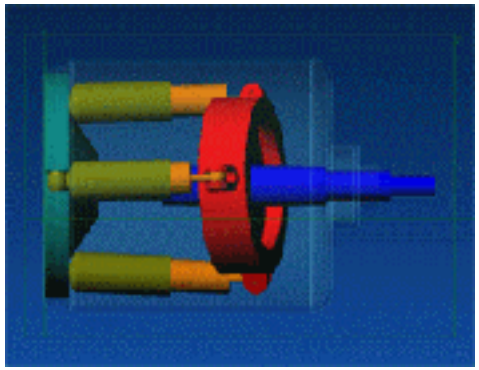
VISUALISATION AND VR IN AGRICULTURAL MECHANISATION cont



Alibre Design Expert 9.1,

Alibre Motion is a motion simulation solution for analyzing the behaviour of mechanical assemblies with moving parts.

When designing mechanical systems and mechanism that move, such as linkages etc., it is important to understand how various components interact and behave according the to engineering principles and physical laws

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VISUALISATION AND VR IN RENEWABLE ENERGY DEVELOPMENT

Engineering Team Intro:

Mahlatse Mamabolo

Agricultural Engineer

ARC –IAE Silverton

DIVISION:

Renewable Energy

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VISUALISATION AND VR IN RENEWABLE ENERGY DEVELOPMENT cont

Virtual Prototype of the Micro Algae Plant

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VISUALISATION AND VR IN RENEWABLE ENERGY DEVELOPMENT cont

Constructed Prototypes of the Micro Algae and Biogas digester

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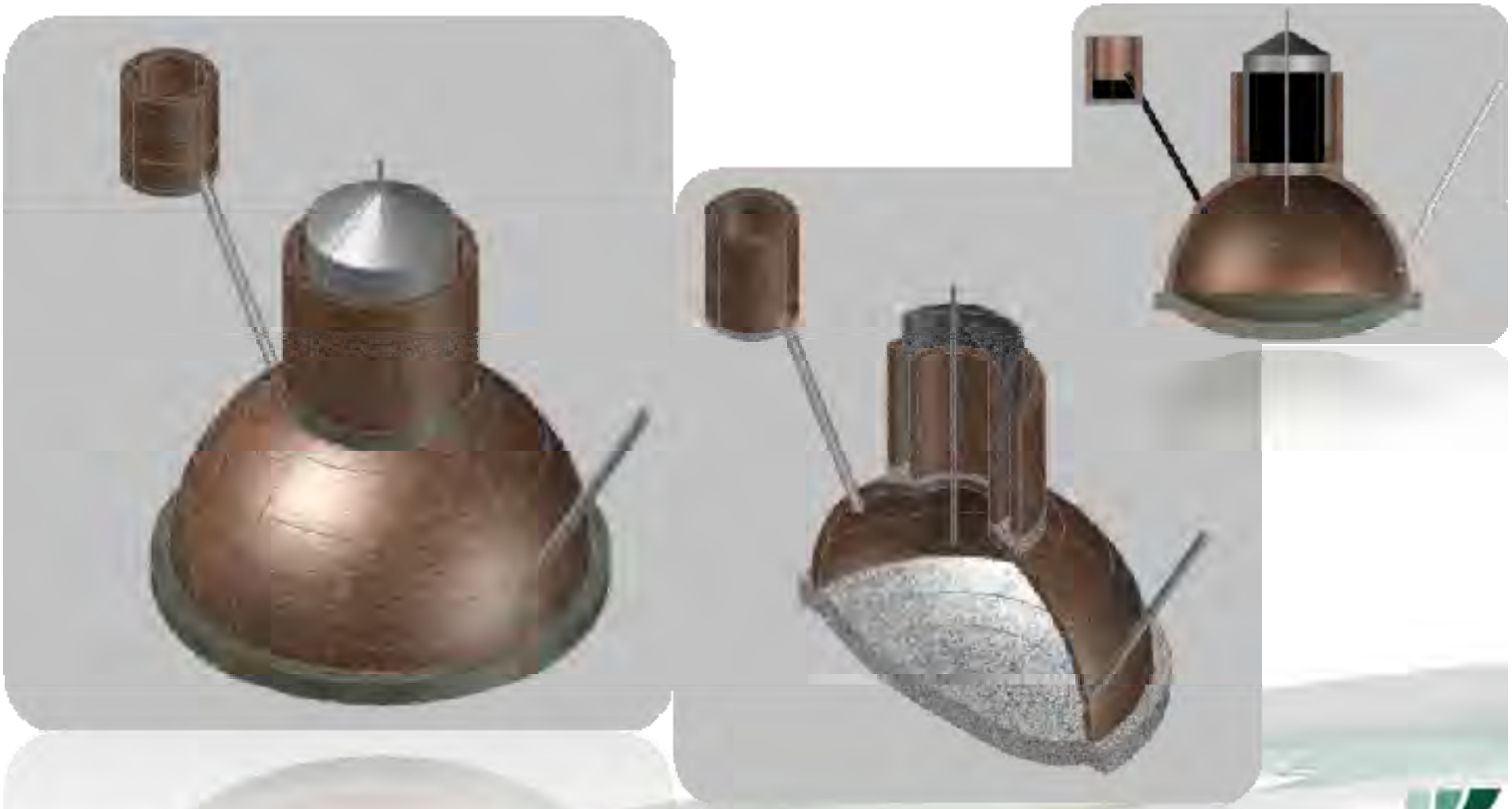
VISUALISATION AND VR IN RENEWABLE ENERGY DEVELOPMENT cont



Biogas Digester Prototype

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VISUALISATION AND VR IN AG ENG AGRO-PROCESSING

Engineering Team Intro:

Phalane Sekina Lebotsa

Agricultural Engineer

ARC –IAE Silverton

DIVISION:

Post Harvest and Storage Technology

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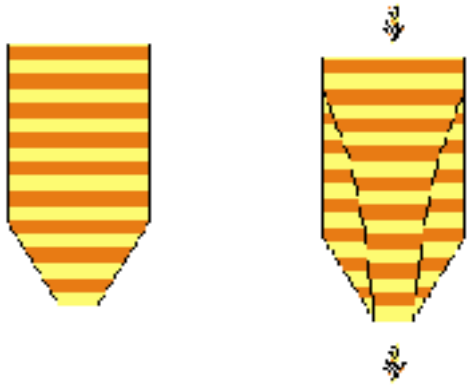
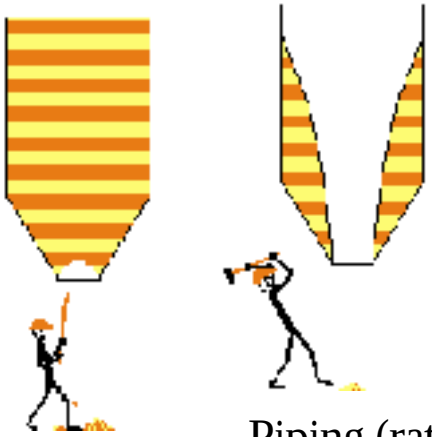
VISUALISATION AND VR IN AG ENG AGRO-PROCESSING cont



Mass flow Funnel flow

Simulation of Flow Profiles: Mass Flow and Funnel Flow



Arching Piping (ratholing)

Flow Problems

SILO STRESS ANALYSER TOOL calculates stresses in silos and bins with simple geometry (e.g. a vertical section plus a hopper). The calculation can be performed for the filling stress state (stress state after an empty silo has been filled) and for the discharge stress state (valid after some bulk solid has been discharged form the (mass flow) silo

Virtual Prototype of the Silos design and simulations

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VISUALISATION AND VR IN AGRICULTURAL WATER

Engineering Team Intro:

Mamashege Gladys Lebotsa

Agricultural Engineer

ARC –IAE Silverton

DIVISION:

Agricultural Water

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VISUALISATION AND VR IN AGRICULTURAL WATER cont

Topographical Surveys data aquisition

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VISUALISATION AND VR IN AGRICULTURAL WATER cont

Topographical Surveys outputs

OUTPUTS AND DISCUSSIONS

The advantages of virtual prototyping are clear:

1. Less real prototypes that consume resources and time to realise,
2. Realistic imaging.
3. Enable Shared resources and optimized collaboration.
4. Better use of time.
5. Virtual prototyping offers enhanced product innovation
6. Innovative, reliable and high-quality products and processes.
7. Fewer physical prototypes and test setups for faster return on investment due to reduced development time.
8. A more flexible and responsive information-based development process, enabling the modification of designs at later stages of development.
9. Seamless working exchange of data regardless of location, industry, CAD environment, etc

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OUTPUTS AND DISCUSSIONS

Virtual Prototyping Limitations:

1. Less real prototypes that consume resources and time to realise,
2. Realistic imaging.
3. Enable Shared resources and optimized collaboration.
4. High software and associated hardware cost.
5. Long learning curve / complexity requires dedicated technical personnel.
6. Typically must be outsourced, resulting in risk path for development schedule.
7. Expensive. Long lead-time.
8. Data is theoretical, must still either prototype or hard tool and test for final verification.
9. Oftentimes must make simplifications to geometries, systems, etc. to facilitate analysis.

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