



Dynamic Analysis and Kinematics Optimization in the Design of a Concrete Distribution Boom

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CIFA S.p.A.

■ Italian and European Leader in:

- ◆ Concrete Production
 - Production Plants

- ◆ Concrete Handling and Placement
 - Concrete-mixers
 - Tunnelling forms
 - Hydraulic booms

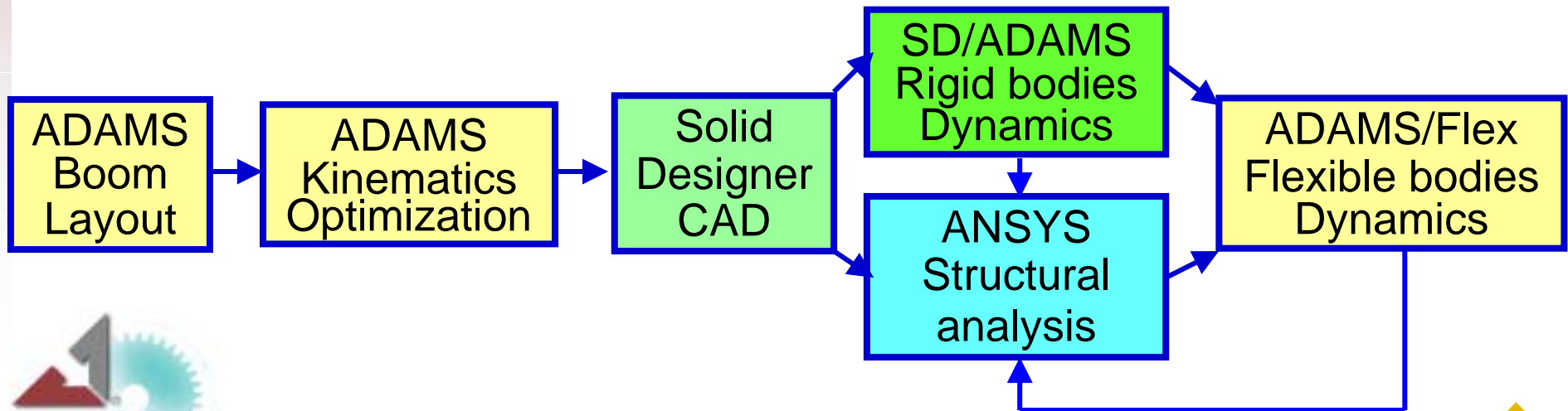
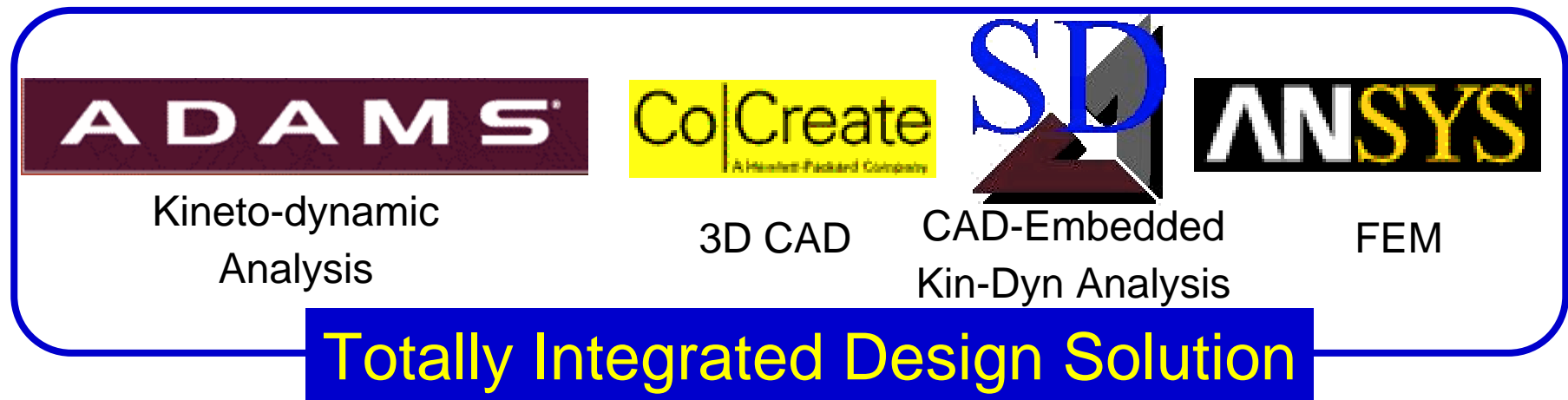


Hydraulic Booms: Main Troubles

- Repetitive Work-cycle
 - ◆ Fatigue Failures Design
- Technical Innovation
 - ◆ New Solutions to Improve Performances
- Structural Optimization
 - ◆ Mass Minimization → High Resistance Materials
- Competitive Background
 - ◆ Struggle in Time-to-Market Reduction.



Integrated CAE Solution



ADAMS: Boom Layout

- Design Matters:
 - ◆ New Booms Configuration
 - ◆ Global Mass Initial Evaluation and Control
 - ◆ Basic Geometric Structure Definition
 - ◆ Basic Mechanisms Definition
 - ◆ Basic Hydraulic Components Definition
 - ◆ Basic Motion Definition.

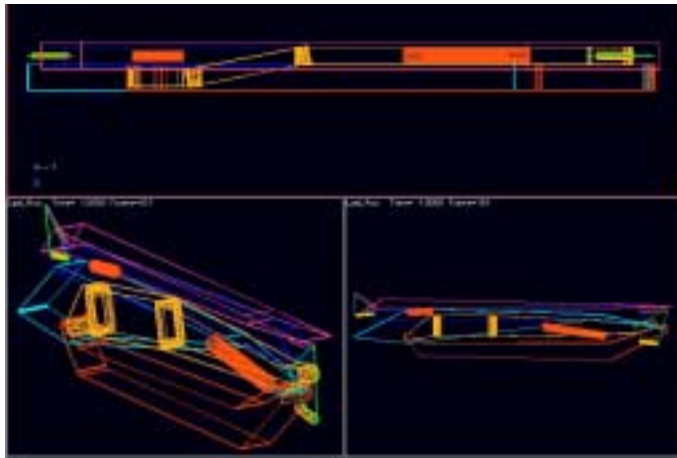
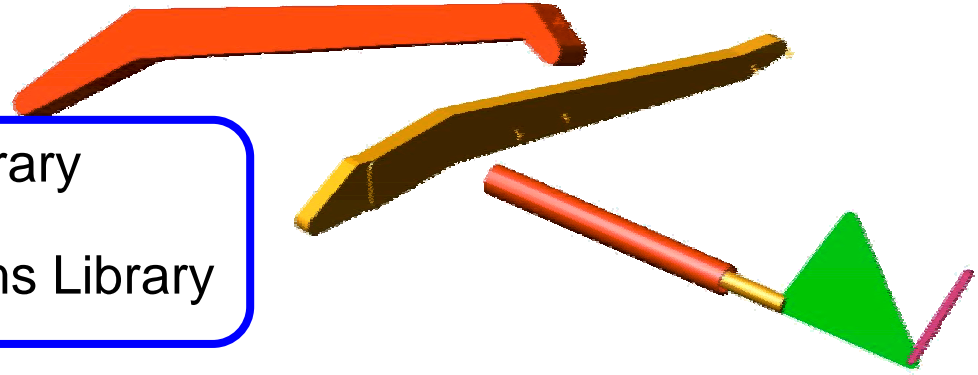
ADAMS: Boom Layout

■ CAE Solution:

- ◆ Parametric Booms Library
- ◆ Parametric Mechanisms Library



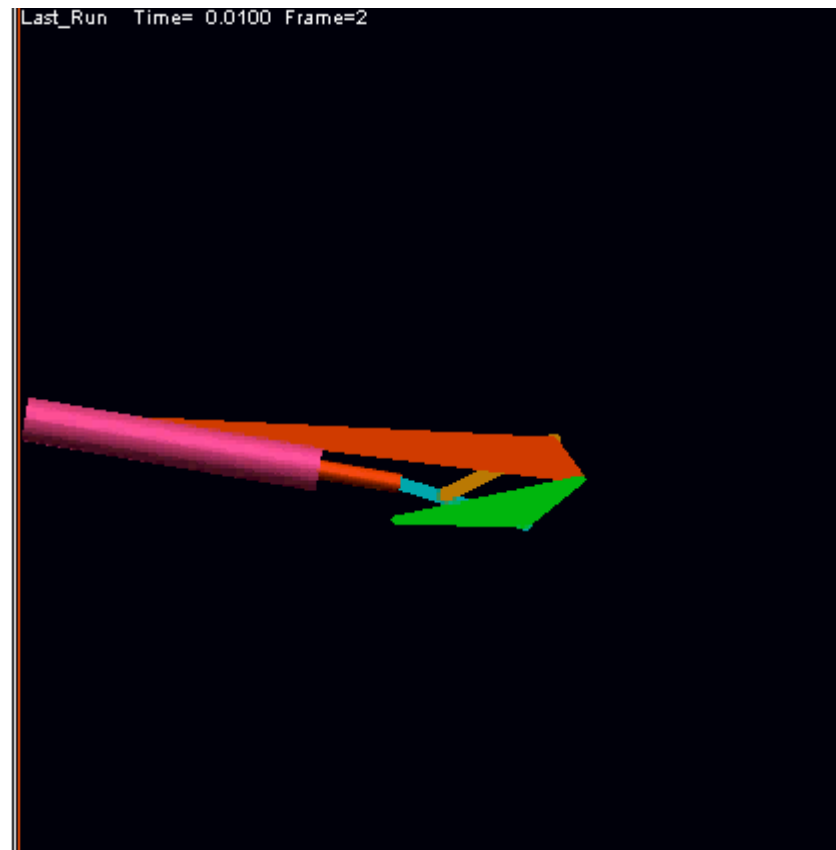
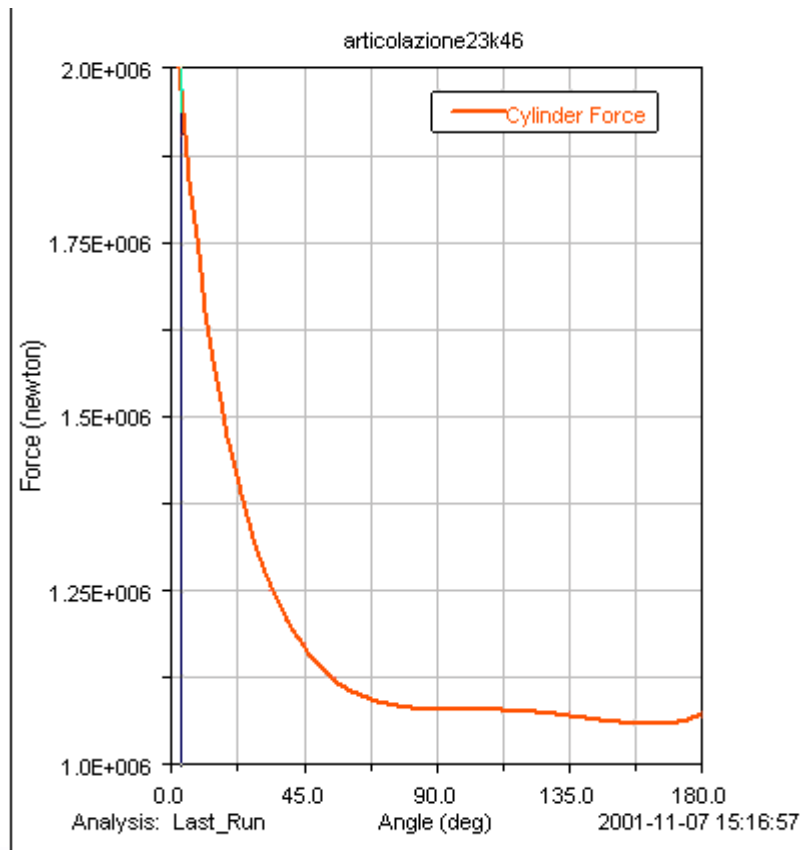
◆ Parametric Assembly



ADAMS: Kinematics Optimization

- Design Matters:
 - ◆ Reaction Forces Oscillations Control
 - ◆ Motions Irregularity
 - ◆ Mechanisms Optimal Configuration
 - ◆ Hydraulic Components Sizing
 - ◆ Articulations Weight Limitation.

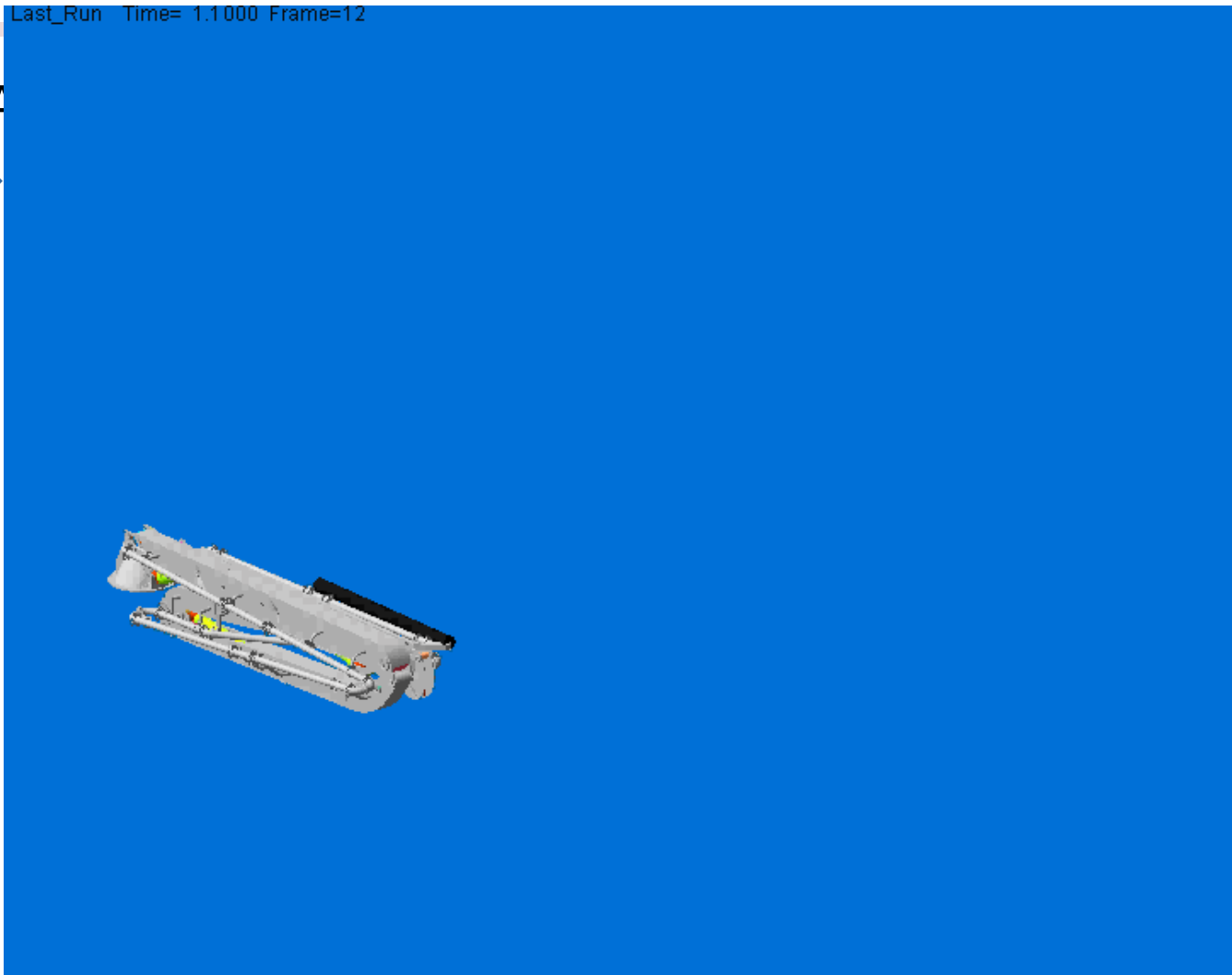
ADAMS: Kinematics Optimization



SD/ADAMS: Rigid Bodies Dynamics

- Design Matters:
 - ◆ Global Boom Real Motion Control
 - ◆ Dynamic Reaction Forces During Working Cycles
 - ◆ Hydraulic Equipment Pressure Verification
 - ◆ Critical Configurations Determination
 - ◆ Loading Evaluation for FEM Analysis.

SD/ADAMS: Rigid Bodies Dynamics



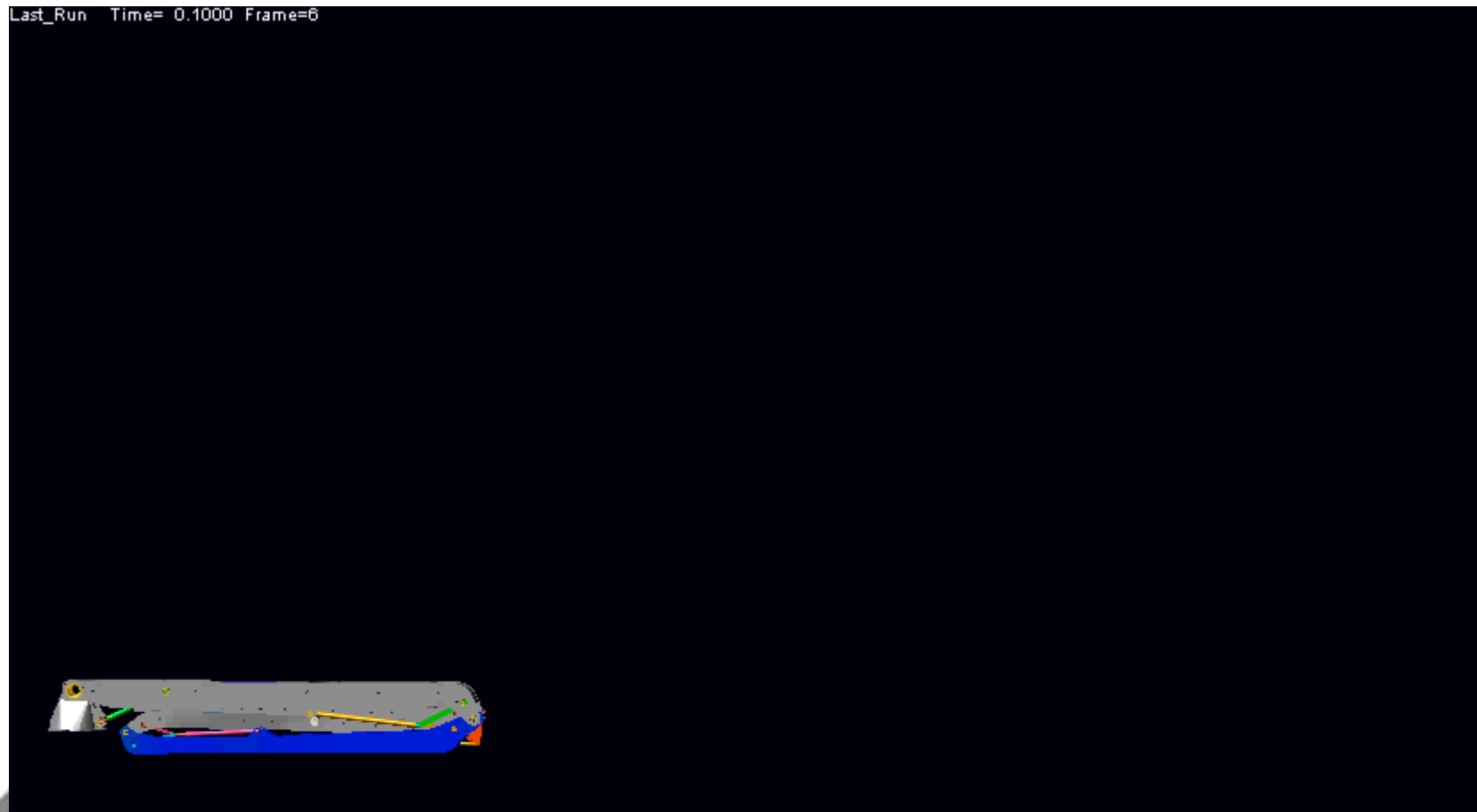
■ CA



A/Flex: Flexible Bodies Dynamics

- Design Matters:
 - ◆ Bodies have NO Real Rigid Behavior
 - ◆ Thin Bodies
 - ◆ Consistent Static Deformation
 - ◆ Serious Dynamic Problems
 - Structure Oscillations in Braking Operations
 - Vibrations from Concrete Pumping System.

A/Flex: Flexible Bodies Dynamics



CAE Solution: Future Objectives

- New Extension of Design Process
 - ◆ Evaluation of Dynamic Flexibility Global Effects
 - Combined Hydraulic-Structural Analysis (A/Hydraulics)
 - Dynamic Stress Analysis (ADAMS/MSR)
 - Fatigue Analysis (ADAMS/Durability)



Reliability Analysis Tool

Conclusions

■ Results

- ◆ Design Time Decrease, Design Results Increase
 - Old Process: ↑ Time, ↑ Approx., ↑ Experimental Control
 - New Process: ↑ Info, ↑ Design Control
- ◆ Physical Prototypes Costs Decrease
 - First Prototype **100%** Functional
- ◆ Performances Increase
 - Light Structure

Conclusions

CIFA K40

Design Time: 2 Months

Presented at SAIE 2001



OUTSTANDING CUSTOMERS SUCCESS