

### **Agenda**

Introduction to Esterel Technologies

SCADE Overview

Summary

Questions & Answers



### **Esterel Technologies**

- Provide critical system and software developers with model-based development solutions that reduce cost, risk and time-to-certification
- SCADE products used extensively by systems and software engineers
- SCADE products and services focus on domain specific modeling and verification
- 100% Proven and Dependable



### **Esterel Technologies Locations**

#### **Direct Offices**

- China
- France
- Germany
- Russia
- **UK**
- **USA**
- Brazil (2012)
- India (2012)

### Channel Partners

Australia: APC Technology

China: MINTEX

India: MISTRAL SOLUTIONS

Israel: ITEC

Italy: MICROTask

Japan: IDAJ Co. Ltd & Kanematsu Aerospace Corp. (KAC)

Korea: Unione-S

Russia: AVD Systems

SE Asia: eACT

Spain: Embedded Technologies

Turkey: Tektronik





### **Industries Served by Esterel SCADE**



**Rail Transportation** 



**Energy & Nuclear** 



Aerospace & Defense



**Industrial & Medical** 

Corporate focus on demanding industries

### **Our Large Customers...**

#### **Aerospace & Defense**



#### Rail Transportation Industrial & Medical Energy & Nuclear





Aeropribor	ELV
Airbus	ESA
Alenia	ESG
AVIC	Eurocopter
Avionika	FADACATEC
BAE SYSTEMS	GE Aviation
BOEING	GE IQ
Bundeswehr	Goodrich
(BWB)	GosNIIAS
CALT	HAL
CASC/CAST	Hispano-Suiza
CETC	Intecs Sistemi
COMAC	Intertechnique
Crane Aerospace	KAL/ADD
DARE	KEEVEN
Dassault Aviation	Liebherr
Defense	Aerospace
Singapore	Lockheed Martin
Diehl Aerospace	Meggitt
DLR	MIEA
EADS CASA	NASA
EADS Astrium	NIIAO
EADS Cassidian	NKBVS
ECICT	Messier-Bugatti
Elbit Systems	OAK
Elektroavtomatika	ONERA
Embraer	Parker

QinetiQ

Poliot Pratt & Whitney Rheinmetall Rolls Royce Aero Saab Avitronics SAIC Safran/ Sagem Snecma Sukhoi Turkish Aerospace Industries Tekhpribor Thales Avionics Thales Training & Simulation Toshiba Aerospace Turbomeca Samsung Thales Ultra Electronics Ulyanovsk US Army Redstone Arsenal **VEGA VNIIRA** Xian Aerospace **ZODIAC** 

Alcatel Shanghai Bell Alstom Transportation Ansaldo STS AREVA TA **BJTU** CAF CASCO Deuta Werke Dimetronic **EFACEC** Engineering AT Hollysys Hyundai Rotem Ikerlan **INVENSYS** Rail Istanbul Ulasim Kyosan Mitsubishi Rail NIIAS NRIET **POSCON** PT I FN RATP Samsung SDS Siemens Rail Transportation

**BMW DCNS** Fuji Heavy GE Energy IKV Liebherr Construction Mitsubishi Johnson Controls NIAT Nihon Seiko PSA Schindler Elevators Subaru Terex Cranes Toyota Automotive Toyota Robotics

AREVA NP
BARC
IGCAR Nuclear Research
Rolls-Royce Civil Nuclear
KAERI
KOPEC
NPCIL
NPIC
Rolls Royce Submarine
Techenergy
VNIIA /Rosatom



Thales Rail Signaling Systems

Systerel

**ELTA** 



### **SCADE Product Line**

System Design



System Architecture, System Verification

Display Software Design



Prototyping, Design, Verification, Qualified Code Generation

Control Software Design



Prototyping, Design, Verification, Qualified Code Generation

Application Lifecycle Mgt

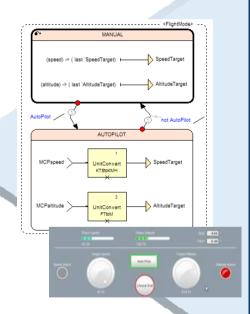


Certification Plans, Metrics,
Requirements & Configuration
Management,
Documentation
Generation



### **SCADE Suite**





PROTOTYPE & DESIGN

## Control Software Design



Model Checking



Debug & Simulation



Model Coverage Analysis



Formal Verification



**Model Diff** 



Time & Stack Analysis

SCADE Suite KCG C & Ada





Object Code & Compiler Verification



DO-178B IEC 61508 EN 50128 Certification Kits

**GENERATE** 

**VERIFY** 



## **SCADE Display**



## Display Software Design



PROTOTYPE & DESIGN



Model Checking



Simulation

**VERIFY** 

SCADE Display KCG







**GENERATE** 



Pervasive SCADE Display Deployment in Civilian and Military Avionics



**Multi-Function Display** 



**Airport Navigation System** 



**Radar Display** 







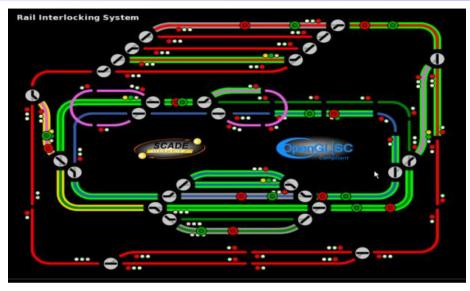
# Pervasive SCADE Display Deployment in Railways Automation



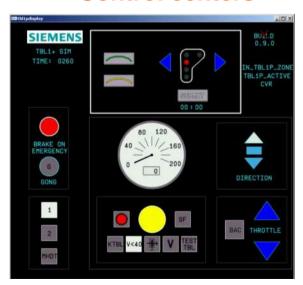
**DMIs (ERTMS)** 



**DMIs (specific)** 



**Control centers** 



**Simulator** 

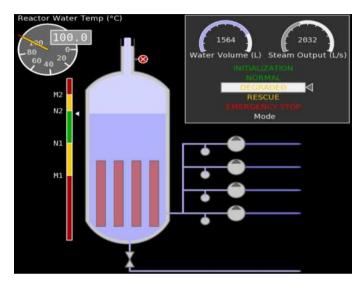


# Pervasive SCADE Display Deployment in the Industry

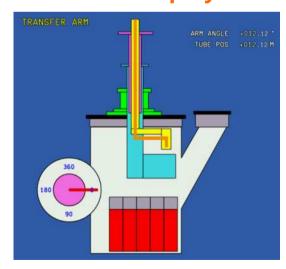


**Automotive Dashboards** 





**Plant Displays** 





## **SCADE LifeCycle**



## System & Software Lifecycle Management













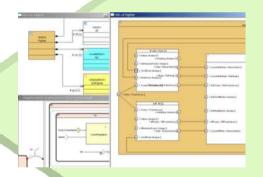
**DOCUMENT** 



## **SCADE System**



System Design



DESIGN



**VERIFY** 



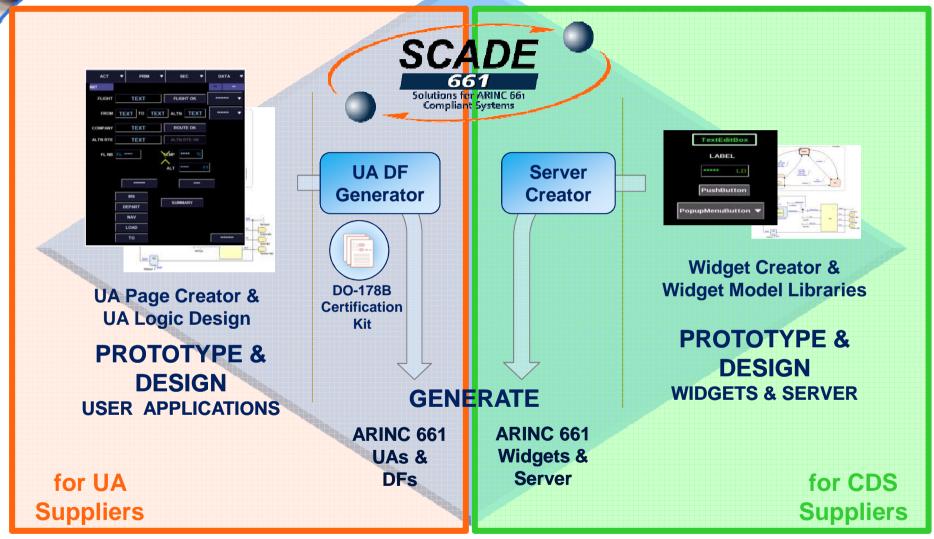
System/Software Sync Up (including I/Os)

**INTEGRATE** 



### **SCADE Solutions for ARINC 661**

### **Modular Solutions**











## These A661 Aircraft ALL use SCADE Display!



### **SCADE Product Partner Ecosystem**



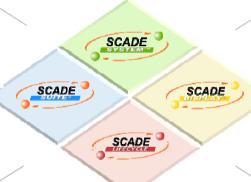






Green Hills'









Esterline

























### **Esterel SCADE Professional Services**

**Esterel Technologies Professional Services Teams deliver:** 

- SCADE Training Services
  - Basic and advanced product training, Process training,
     over-the-shoulder ramp-up support, SCADE modeling optimization
- Project Support Services
  - Methodology guidelines
  - ▶ Tool integration, tool customization and tool qualification services
- Safety Certification Expertise Services
  - Certification plans and artifacts development
  - Relationship assistance with certification authorities

ISO 9001:2008 Certification to Deliver Expert Consulting and Training for Mission- and Safety-critical Software

## **SCADE DO-178B Methodology Handbooks**

### Contents:

- Development and verification steps
  - Model-based development with SCADE
  - Simulation and Model Test Coverage
  - Formal verification
  - Automatic code generation with KCG
  - C compiler verification activities
- Set of guidelines for developing efficient models, generating efficient code, etc.
- Two versions available for Display centric and Control centric applications



Download the handbook from www.esterel-technologies.com





### **SCADE Aeronautics Applications**

- Autopilots
- Anti-icing
- Braking and Landing Gear Systems
- Cabin Pressure and Climate Control
- Cockpit Display Systems
- Doors and Slides
- Electronic Flight Bags
- Engine Control Systems (FADEC)
- Flight Control Systems / HighLift / Slat and Flaps
- Flight Management Systems
- Flight Warning Systems

- Fuel Management
- Heads-up Display
- Hydraulic Controls
- Navigation, Guidance and Inertial Units
- Nacelle Control Systems
- On-Board Airport NavigationSystems
- On-Board Maintenance System
- Oxygen Control units
- Power Management & APU
- Training and Simulation systems
- Thrust Reversers
- Water/Waste



### **SCADE Rail Automation Applications**

- Automatic Train Control and Protection Systems: ETCS, CTCS & CBTC
  - Emergency braking, overspeed protection, vehicle speed control, ATP/ATO
  - Satellite-based locomotive control
  - On-board displays (DMI)
- Interlockings
- Doors opening and departure interlocks
- Train detection systems (Axle counters)
- Level Crossing Protection
- Control Centers: Fault reporting and Interlocking Displays



Korea POSCON - Platform Screen Door



RATP - Paris Metro



Ansaldo Signal



Siemens Rail Transportation



### **SCADE Industrial Applications**

- Offshore, Crawler & Harbor Cranes
- Excavators
- Tractors
- Earth Moving Machines
- Trucks
- Construction equipment, Bulldozers
- Mining machines
- Braking systems, ABS & ESP
- Electrical cars
- Medical systems
- Robotics systems



Liebherr Construction

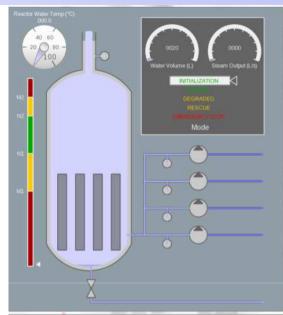


GE Energy



### **Esterel SCADE in Nuclear I&C Applications**

- Reactor Protection Systems
  - Reactor limitation system
  - Trip processing & Emergency shutdown
  - Safety actuation
- Nuclear Instrumentation & Display Systems
  - Reactor Monitoring Displays
  - Power measurement system
  - Neutron detectors
  - Pressurizer heating controllers
- Other Safety Systems
  - Safety valve control system
  - Rod control systems
  - Diesel sequencing system
  - Rod position instrumentation systems





A wide range of Nuclear I&C applications





### What is Unique About SCADE?

- SCADE is developed specifically to address critical system and software applications
- SCADE Suite and Display code generators are certified/qualified according to the following international safety standards:
  - DO-178B / DO-178C (2012) qualification up to Level A Aerospace & Defense
  - ► EN 50128 certification up to SIL 3/4 Rail Transportation
  - ▶ IEC 61508 certification up to SIL 3 Industrial & Energy
    - ▶ IEC 60880 full compliance Nuclear Instrumentation & Control
    - ► IEC 62304 full compliance Medical systems
    - ► EN 13849 full compliance Industrial Machines Safety
  - **▶ ISO 26262** certification up to ASIL D Automotive (2012)

Same product qualified at the highest level of safety across 6 market segments by 10 safety authorities, worldwide.



### **Strategic SCADE Benefits**

**Design Process** 

SCADE aligns the Design Process according to Safety Standards Objectives

50%

**Development Costs Reduction** 

**2X** 

**Time-to-Certification Speed up** 





