Maximizing Cost Efficiencies and Productivity for AMOLED Backplane Manufacturing

Elvino da Silveira

RUDOLPH TECHNOLOGIES

Agenda

Introductions & Trends

Consumer products driving AMOLED Adoption!

Lithography Challenges

Devices performance increase lithography requirements

Meeting the Challenges

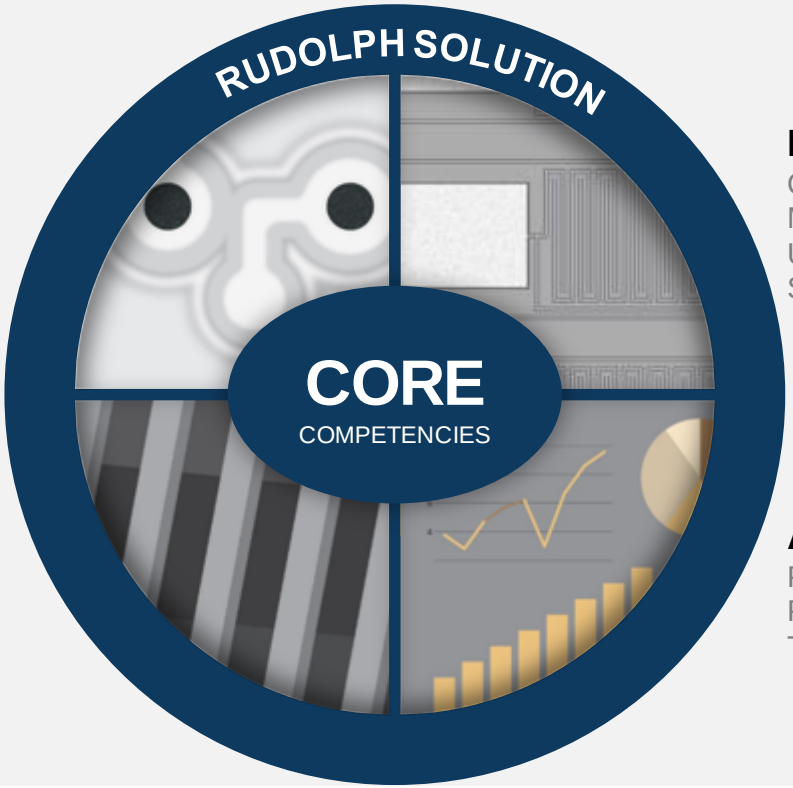
Innovative solutions to meet demanding cost targets!

Future Solution

Beyond lithography, process control!

About Rudolph

Process solutions across the semiconductor industry

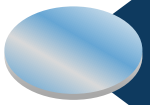


INSPECT
Macro Defects Silicon to Die
Dicing and Chipping Detection
Interconnect Metrology
3D/2D Inspection
Residue Detection

MEASURE
On Product and In-die
Multi-layer Film Stacks
UBM, RDL, PR, PI, Dielectrics
Structure CD

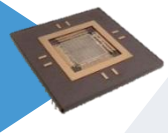
IMAGE
Lithography down to 2µm
Fan-out and Cu Pillar
Wafer and Panel

ANALYZE
Process Analysis
Process Control
Tool-centric and Fabwide



FRONT-END

BACK-END



SILICON

RUDOLPH SOLUTIONS APPLY ACROSS THE SEMICONDUCTOR VALUE CHAIN

TEST

AMOLED Trends

Increased Mobility & Function Driving New Technology Adoption

Adoption of AMOLED

Products driving more adoption

New Form Factors

Next generation products

OLED Materials

Flexible Substrates

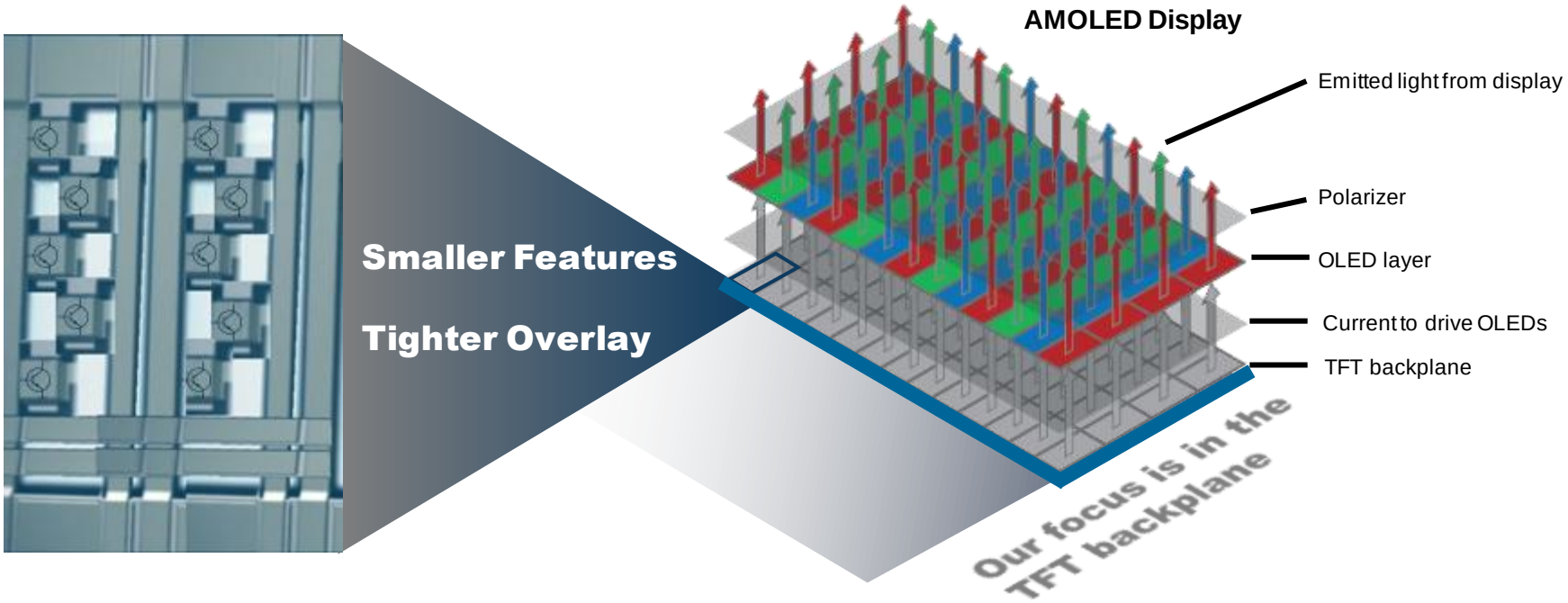
Higher pixel per inch (PPI)

Trends Mandate Changes in Display Production Equipment

Source: IHS

AMOLED Display Overview

Backplane common to all displays

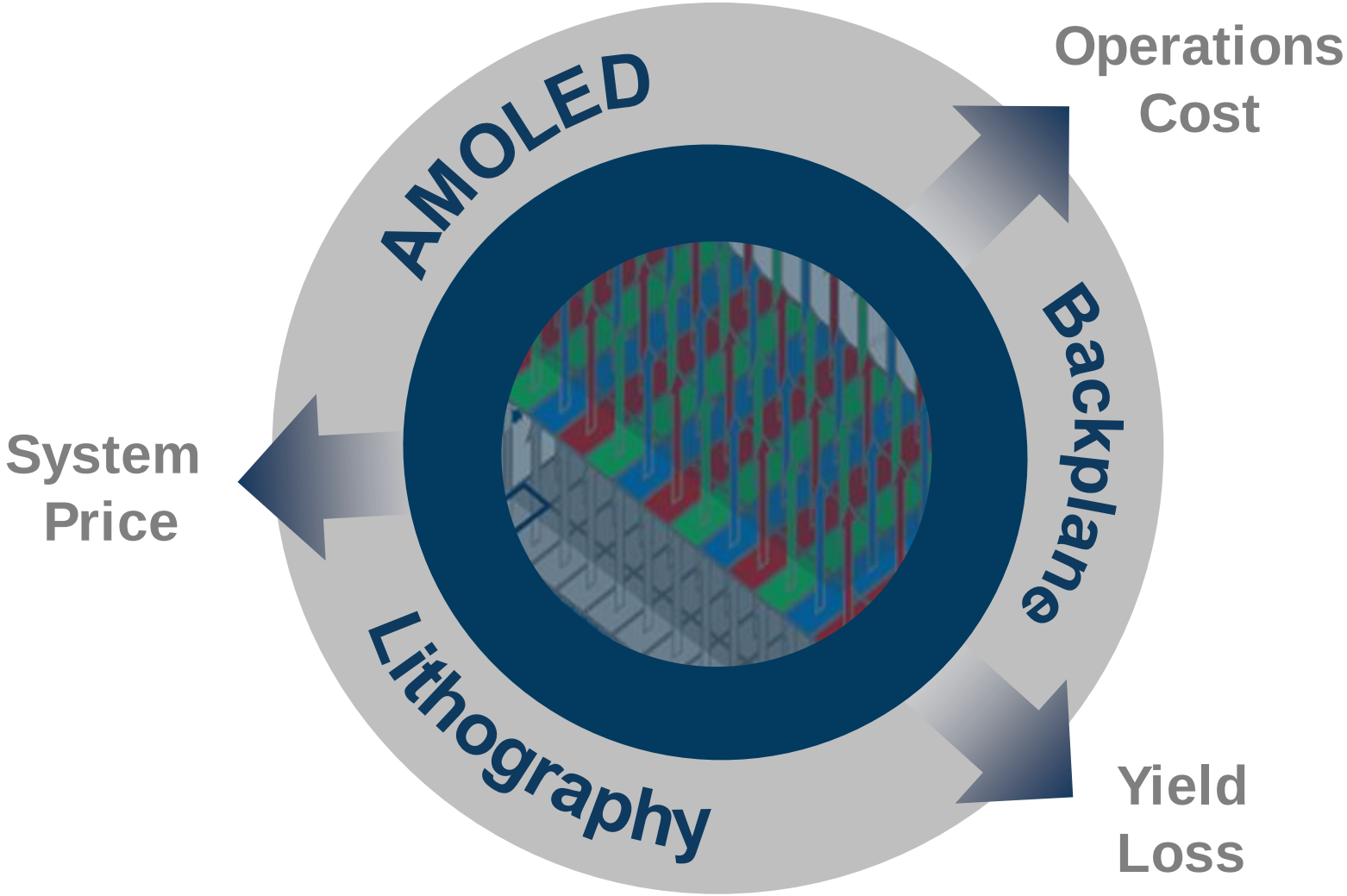


Increasing number of transistors and electrical requirements

Drive stringent lithography to meet AMOLED backplanes

Building Up the Model

AMOLED cost drives



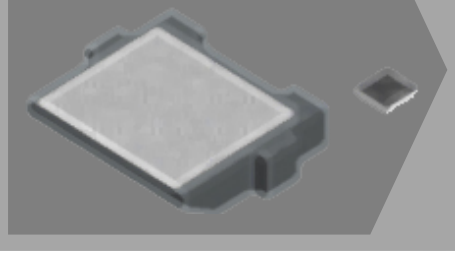
Lithography Solution Based on innovation

Technology

METROLOGY

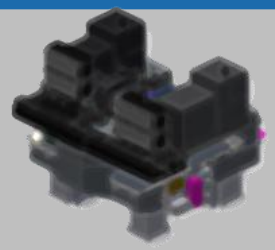
LARGE FIELD LENS

SCALABLE STAGE



Software Capability

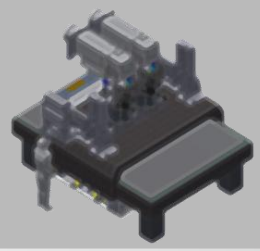
PARALLEL EXPOSURE



SOFTWARE SUITES

AMOLED Solution

G6 LITHOGRAPHY



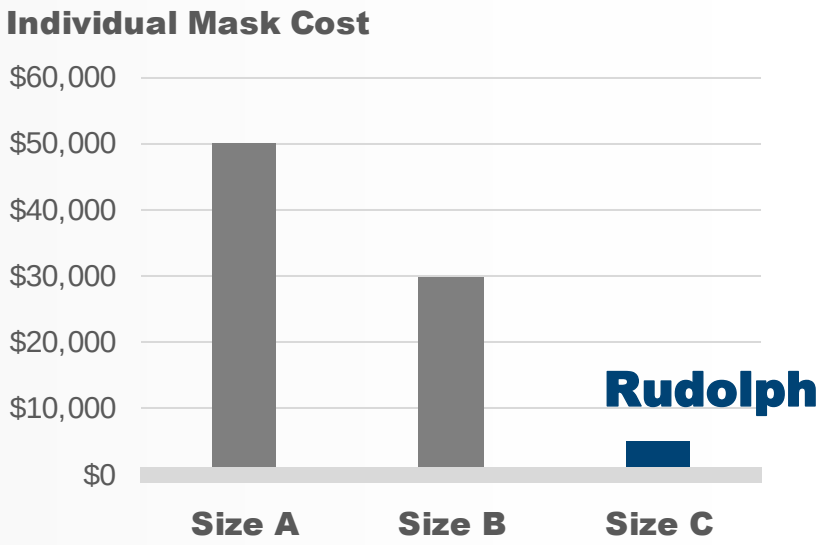
Leveraging Technology and Software

Tooling Cost

GEN 6 MASK SIZE COMPARISON GRAPHIC	GEN 6 COST COMPARISON
Glass Size: 177.6 mm x 177.6 mm	850 mm x 1200 mm
Cost: USD $2-3k per mask	Cost: USD >$30k per mask
Magnification: 1.25x (enlarger)	Magnification: 1:1
Number of Masks per exposure: 2	Number of Masks per Exposure: 1

Size A: 850*1200
Size B: 800*920

Rudolph
Size C: 177.6*177.6mm



Reduce Costs and Improve Utilization

Reduces Consumables Costs
No lamp replacement (est. 79K savings/year)

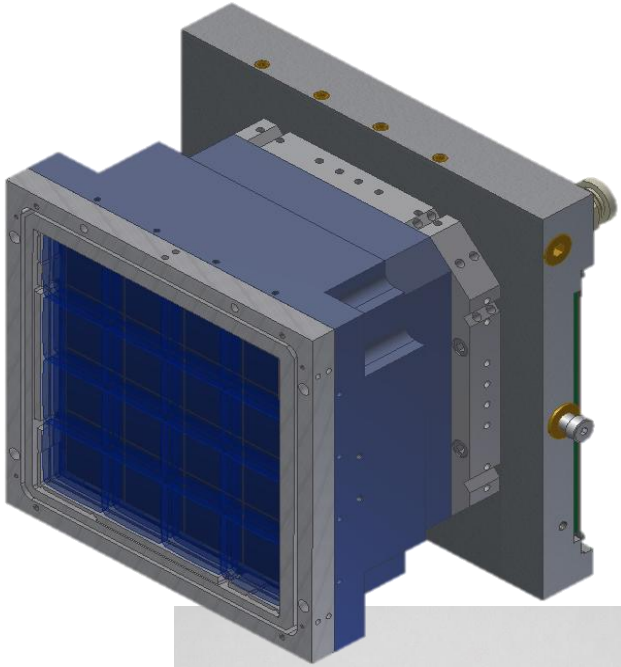
Reduces Operation Costs
> 21000 KW/mo and 500 CFM cleanroom air

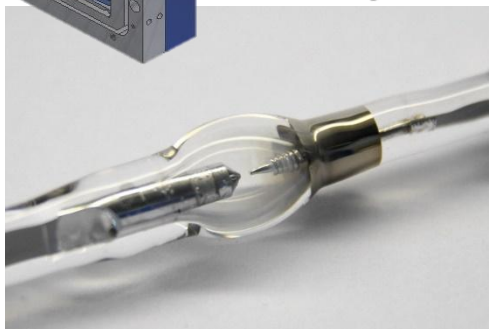
Improves Performance
Better dose control

Increases Throughput
No shutter delays

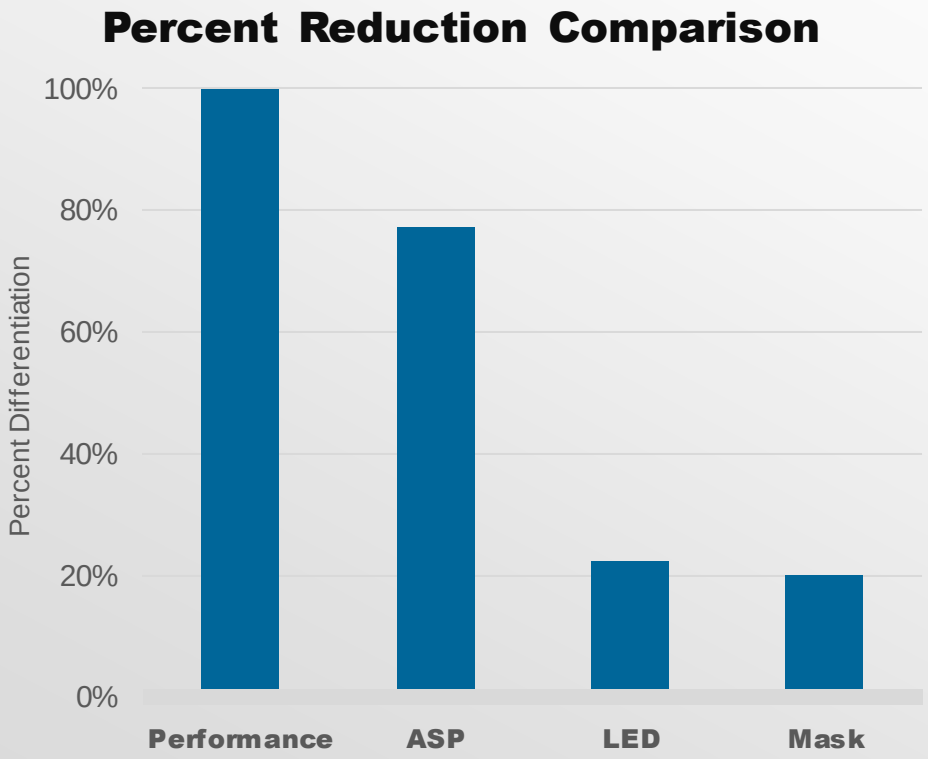
Higher System Utilization
No machine down to replace lamp

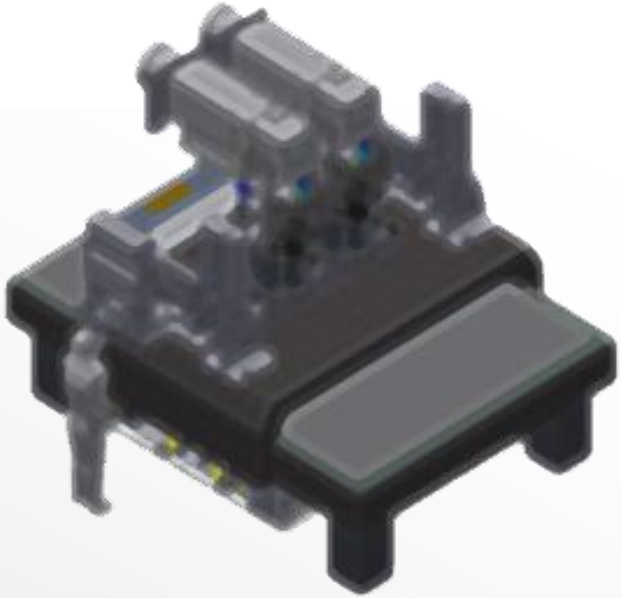
Improved Reliability
No moving parts





Lithography Cost Differentiation





Equal Performance
22% Lower ASP

LED Light Source
No High Power Hg Lamp
>70% Lower Consumable Cost

Lower Mask Cost
Results **>5X** savings per layer

Superior Value of Ownership

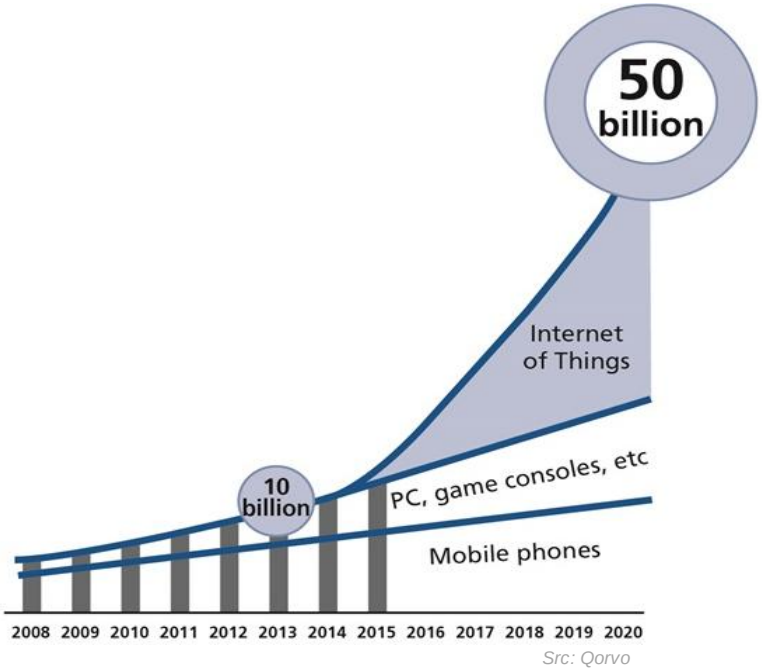
Addressing Quality in the Display Industry

Increased complexity

Higher unit counts and I/O

Strict quality-control metrics

Higher Unit Volumes



APPLE ON THE IMPORTANCE OF QUALITY

"We started off with a very idealistic perspective-that doing something with the highest quality, ***doing it right the first time, would really be cheaper than have to go back and do it again****"*

Software Expanding Rudolph Value

Innovative software solutions contributing to Rudolph growth

Genesis™ Software

- Fast/flexible connection
- Integrated DB-many data
- Handling large data set

OEM Integration

INTELLIGENT DIAGNOSTICS

Expanding across the Enterprise

ACTIONABLE INTELLIGENCE

Connected Data
End to End Analytics

MINIMIZING RISK

CREATING VALUE

Connectiong Digital Threading enables rapid product diagnostics

Summary

Comprehensive Solution

Accelerated Adoption of AMOLED in Mobility Products

Increased unit counts and AMOLED Adoption

Driving need for comprehensive solutions

Integrated Solutions Address

Factory Wide Monitoring, Diagnostics and Capability to Expand into Enterprise

Solutions require collaboration…

We look forward to partnering to identify and implement those solutions.

Special thanks to Simax our local partner

谢谢 | 謝謝

danke

ありがとう

Thank You!

감사합니다

merci

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RUDOLPH TECHNOLOGIES

About the Speaker

ELVINO DA SILVEIRA

Vice president of business development at Rudolph Technologies, with responsibilities to identify new markets and develop strategies to prosecute the opportunities. Until the Rudolph acquisition in December 2012, he served as president and operations manager of Azores since its inception in March 1999. Prior to forming the company, he was employed by MRS Technology, Inc., as the vice president of operations and worldwide customer support. da Silveira has also held engineering and customer support roles at Hampshire Instruments from 1991 to 1993 and GCA/General Signal from 1984 to 1991. Mr. da Silveira holds a B.S. in Mechanical Engineering from Northeastern University.