SOCIETY OF TRIBOLOGISTS AND LUBRICATION ENGINEERS

71st Annual Meeting & Exhibition
May 15-19, 2016 • Las Vegas, Nevada
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The 2016 STLE Annual Meeting & Exhibition is sponsored by the Society of Tribologists and Lubrication Engineers, an international organization headquartered at 840 Busse Highway, Park Ridge, Illinois (USA) 60068-2376. Telephone: (847) 825-5536. Fax: (847) 825-1456. Email: information@stle.org. Web: www.stle.org. STLE is a not-for-profit professional society founded in 1944 to advance the science of tribology and best practices in lubrication engineering.
Welcome to five days of world-class education, training and networking

Dear Members, Friends and Guests,

WELCOME TO STLE’S 71ST ANNUAL MEETING & EXHIBITION!

Two key STLE committees, the Annual Meeting Program Committee and the Education Committee, have assembled a challenging technical program featuring more than 500 technical presentations. You can look forward to an outstanding week of professional development here in Las Vegas.

In addition to the technical sessions, the meeting’s program includes 12 one-day education courses taught by the leading technical experts in their respected fields and many chances to network with and learn from your peers in the tribology-research and lubricant communities. I also encourage you to take time out of your annual meeting schedule to visit with some 100 companies displaying in the trade show. This is an opportunity to get an early look at the newest technologies the lubricants industry has to offer.

With so many events and activities to choose from, the only problem with STLE’s annual meeting might be planning your personal itinerary. This Program Guide and the Annual Meeting Mobile App will help you navigate an event that grows each year.

Remember, also take advantage of the social events, including Monday evening’s Welcoming Party and the Presidents Luncheon Tuesday at noon. You’ll reconnect with the entire STLE community and have a chance to recognize the many volunteers who generously donated their service in the last 12 months to create new programs for all of us involved in the science of tribology and best practices in lubrication engineering.

During your time in Las Vegas, be sure to put your networking skills to work, whether it involves initiating a conversation with a colleague at an education course, technical session or during one of the scheduled refreshment breaks.

By popular demand, we’ve brought back the STLE Lounge, adjacent to the trade show. The lounge is a great place to relax and conduct business with personnel from exhibiting companies.

I also urge you to take advantage of the Commercial Marketing Forum, where you can hear commercial presentations from the lubricant industry’s most innovative companies. The forum sessions are listed with the technical tracks in this program guide.

STLE’s 2016 Annual Meeting & Exhibition is a singular opportunity to discover technical concepts and make personal contacts that will help you better serve your employer and customers and advance your career. In just five days you’ll have access to a wealth of technical information that would take you months to find on your own.

Please say hello if you see me in the hallways or meeting rooms. I look forward to taking this journey with you.
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Daily Schedule at a Glance

SUNDAY, MAY 15
Registration (7 am – 6 pm) – Grand Salon
Speakers Breakfast (7 – 8 am) – Platinum
Education Courses (8 am – 5 pm)
  • Advanced Lubrication 301: Advanced Additives – Las Vegas 6/7
  • Basic Lubrication 101: Lubrication Fundamentals – Jubilee 2
  • Condition Monitoring 101 – Jubilee 1
  • Gears 101: Fundamentals of Gears – Las Vegas 1
  • Metalworking Fluids 130: Metal Treatment Chemical – Las Vegas 3
  • NLGI Grease 101 – Las Vegas 2
  • Synthetics 203: Non-Petroleum Fluids & Their Uses – Las Vegas 1
  • Nanotribology Special Session (1:30 – 5 pm) – Palace 3
Golf Outing (1 – 7 pm)
Hoover Dam Tour (1 – 5 pm)
Student Networking Event (7 – 9 pm) – Liaison Lounge

MONDAY, MAY 16
Registration (7 am – 6 pm) – Grand Salon
Speakers Breakfast (7 – 8 am) – Platinum
Technical Sessions (8 – 10 am)
  1A Commercial Marketing Forum I – Bronze 4
  1B Lubrication Fundamentals I: Rheology – Bronze 3
  1C Engine & Drivetrain I – Bronze 2
  1D Grease I – Gold
  1E Metalworking I – Silver
  1H Fluid Film Bearings I – Las Vegas 1
  1I Biotribology I – Las Vegas 2
  1K Ceramics & Composites I – Las Vegas 5
  1M Seals I – Las Vegas 6/7
  1N Surface Engineering I – Jubilee 1
  1O Materials Tribology I – Jubilee 2
  1P Nanotribology I: Nanomaterials and Nanoscale Analysis – Jubilee 3
NLGI Certification Exam (10 am – Noon) – Skyview 4
Opening General Session (10:30 am – Noon)
Keynote Address (Dr. Andrew L. Randolph, Technical Director, Earnhardt-Childress Racing Engines, Welcome, NC) – Platinum
Lunch (Noon – 1:30 pm) – On your own
Commercial Exhibits & Student Posters (Noon – 5 pm) – Bally’s Event Center

Technical Sessions (1:30 – 6 pm)
  2A Commercial Marketing Forum II – Bronze 4
  2B Lubrication Fundamentals II: Surface Coatings – Bronze 3
  2C Engine & Drivetrain II – Bronze 2
  2D Grease/Rolling Element Bearings Joint Session I – Gold
  2E Metalworking II – Silver
  2G Gears I – Palace 4/5
  2H Fluid Film Bearings II – Las Vegas 1
  2I Biotribology II – Las Vegas 2
  2J Power Generation I: Power Gen Lubricants – Las Vegas 3
  2L Synthetics & Hydraulics I – Las Vegas 5
  2M Seals II – Las Vegas 6/7
  2N Surface Engineering II – Jubilee 1
  2O Materials Tribology II – Jubilee 2
  2P Nanotribology II: Nanomaterials and Nanoscale Analysis – Jubilee 3
Exhibitor Appreciation Break (3 – 4 pm) – Bally’s Event Center
Welcoming Party (6:30 – 8 pm) – Platinum

TUESDAY, MAY 17
Registration (7 am – 6 pm) – Grand Salon
Speakers Breakfast (7 – 8 am) – Platinum
Commercial Exhibits & Student Posters (9:30 am – Noon & 2 – 5:30 pm) – Bally’s Event Center
Technical Sessions (8 am – Noon)
  3A Commercial Marketing Forum III – Bronze 4
  3B Lubrication Fundamentals III: Elastohydrodynamic Lubrication – Bronze 3
  3C Engine & Drivetrain III – Bronze 2
  3D Rolling Element Bearings I – Skyview 3
  3E Metalworking III – Silver
  3F Grease II – Palace 3
  3G Gears II – Palace 4/5
  3H Fluid Film Bearings III – Las Vegas 1
  3I Biotribology III – Las Vegas 2
  3J Power Generation II: Controlling Varnish – Las Vegas 3
  3K Ceramics and Composites II – Las Vegas 4
  3L Synthetics & Hydraulics II – Las Vegas 5
  3M Seals III – Las Vegas 6/7
  3N Surface Engineering III – Jubilee 1
  3O Materials Tribology III – Jubilee 2
  3P Nanotribology III: Nanoparticle Additives – Jubilee 3
### Daily Schedule at a Glance

**Presidents Luncheon/Business Meeting** (Noon – 2 pm) – Platinum

**Technical Sessions** (2 – 6 pm)
- **4A Commercial Marketing Forum IV** – Bronze 4
- **4B Lubrication Fundamentals IV: Computational EHL** – Bronze 3
- **4C Engine & Drivetrain IV** – Special Session – Advances in Lubricants and Automotive Tribology for Fuel Economy – Bronze 2
- **4D Rolling Element Bearings II** – Skyview 3
- **4E Metalworking IV** – Silver
- **4F Non-Ferrous Metals I: Additives** – Palace 3
- **4G Gears III** – Palace 4/5
- **4H Fluid Film Bearings IV** – Las Vegas 1
- **4I Biotribology IV** – Las Vegas 2
- **4J Power Generation III: Contamination Control** – Las Vegas 3
- **4K Wear I: Experimental Study of Wear** – Las Vegas 4
- **4L Synthetics & Hydraulics III** – Las Vegas 5
- **4M Seals IV** – Las Vegas 6/7
- **4N Surface Engineering IV** – Jubilee 1
- **4O Materials Tribology IV** – Jubilee 2
- **4P Nanotribology IV: Nanoparticle Additives** – Jubilee 3

**Exhibitor Appreciation Break** (3 – 4 pm) – Bally’s Event Center

**TUESDAY BUSINESS MEETINGS**

**3F** • Palace 3 – Grease II (11:30 am – Noon)  
Grease Business Meeting

**3K** • Las Vegas 4 – Ceramics and Composites II  
(11:30 am – Noon) Ceramics and Composites Business Meeting

**4B** • Bronze 3 – Lubrication Fundamentals IV – Computational EHL (5 – 5:30 pm)  
Lubrication Fundamentals Business Meeting

**4C** • Bronze 2 – Engine & Drivetrain IV – Special Session: Advances in Lubricants and Automotive Tribology for Fuel Economy (5:30 – 6 pm)  
Engine and Drivetrain Business Meeting

**4D** • Skyview 3 – Rolling Element Bearings II (6 – 6:30 pm)  
Rolling Element Bearings Business Meeting

**4E** • Silver – Metalworking IV (6 – 6:30 pm)  
Metalworking Business Meeting

**4F** • Palace 3 – Non-Ferrous Metals I: Additives (5 – 5:30 pm)  
Non-Ferrous Business Meeting

**4G** • Palace 4/5 – Gears III (5 – 5:30 pm)  
Gears Business Meeting

**4H** • Las Vegas 1 – Fluid Film Bearings IV (5:30 – 6 pm)  
Fluid Film Bearings Business Meeting

**4J** • Las Vegas 3 – Power Generation III: Contamination Control (5 – 5:30 pm)  
Power Generation Business Meeting

**4L** • Las Vegas 5 – Synthetics & Hydraulics III  
(5:30 – 6 pm) Synthetics & Hydraulics Business Meeting

**4M** • Las Vegas 6/7 – Seals IV (4 – 4:30 pm)  
Seals Business Meeting

**4O** • Jubilee 2 – Materials Tribology IV (6 – 6:30 pm)  
Materials Tribology Business Meeting

**4P** • Jubilee 3 – Nanotribology IV: Nanoparticle Additives (6 – 6:30 pm)  
Nanotribology Business Meeting

**WEDNESDAY, MAY 18**

**Registration** (7 am – 6 pm) – Grand Salon

**Speakers Breakfast** (7 – 8 am) – Platinum

**Commercial Exhibits** (9:30 am – Noon) – Bally’s Event Center

**Education Courses** (8 am – 5 pm)
- Advanced Lubrication 302: Advanced Lubrication Regimes – Skyview 1
- Automotive Lubrication 202: Gasoline – Skyview 2
- Basic Lubrication 102: Basic Applications – Skyview 3
- Metalworking Fluids 105: Introduction to Metal Forming Fluids – Skyview 4
- Synthetic Lubricants 204: Fluid Formation & Application – Skyview 6

**Technical Sessions** (8 am – Noon)
- **5A Commercial Marketing Forum V** – Bronze 4
- **5B Lubrication Fundamentals V** – Additives – Bronze 3
- **5C Engine & Drivetrain V** – Bronze 2
- **5E Rolling Element Bearings III** – Gold
- **5F Non-Ferrous Metals II: Bio-Based Lubricants** – Palace 3
- **5G Wind Turbine Technology I** – Palace 4/5
- **5H Fluid Film Bearings V** – Las Vegas 1
- **5I Environmentally Friendly Fluids I** – Las Vegas 2
- **5K Wear II: Analysis of Friction and Wear** – Las Vegas 4
- **5L Tribotesting I** – Las Vegas 5
- **5M Condition Monitoring I** – Las Vegas 6/7
- **5N Surface Engineering V** – Jubilee 1
- **5O Materials Tribology V** – Jubilee 2
- **5P Nanotribology V: Nanoscale Lubrication Mechanisms** – Jubilee 3
Daily Schedule at a Glance

WEDNESDAY, MAY 18

Technical Sessions (1:30 – 6 pm)
6A Commercial Marketing Forum VI – Bronze 4
6B Lubrication Fundamentals VI: Tribofilms – Bronze 3
6C Engine & Drivetrain VI – Bronze 2
6D Rolling Element Bearings IV – Gold
6F Non-Ferrous Metals III: Tribology – Palace 3
6G Wind Turbine Technology II – Palace 4/5
6H Fluid Film Bearings VI – Las Vegas 1
6I Environmentally Friendly Fluids II – Las Vegas 2
6K Wear III – Las Vegas 4
6L Tribotesting II – Las Vegas 5
6M Condition Monitoring II – Las Vegas 6/7
6N Surface Engineering VI – Jubilee 1
6O Materials Tribology VI – Jubilee 2
6P Nanotribology VI: Nanoscale Lubrication Mechanisms – Jubilee 3 (1:30 – 3 pm)
6Q Materials Tribology/Nanotribology Joint Session I: Mechanics and Tribochemistry at the Nanoscale – Jubilee 3 (3:30 – 6:30 pm)

Beverage Breaks are scheduled at 10 am and 3 pm daily.

WEDNESDAY BUSINESS MEETINGS

6G • Palace 4/5 – Wind Turbine Technology II
   (6 – 6:30 pm) Wind Turbine Technology
   Business Meeting
6I • Las Vegas 2 – Environmentally Friendly Fluids II
   (5 – 6 pm) Environmentally Friendly Fluids
   Business Meeting
6K • Las Vegas 4 – Wear III (5:30 – 6 pm)
   Wear-Biotribology Business Meeting
6L • Las Vegas 5 – Tribotesting II (5 – 5:30 pm)
   Tribotesting Business Meeting

THURSDAY, MAY 19

Registration (7 am – 6 pm) – Grand Salon
Speakers Breakfast (7 – 8 am) – Platinum
STLE Certification Exams (8:30 am – Noon) – Palace 3
Technical Sessions (8 am – Noon)
7B Lubrication Fundamentals VII: Lubricant Properties – Bronze 2
7C Engine & Drivetrain VII – Bronze 3
7D Rolling Element Bearings V – Gold
7E Molecular Chemistry and Lubricant Rheology I – Silver
7H Fluid Film Bearings VII – Las Vegas 1
7K Wear IV – Las Vegas 4
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7M Condition Monitoring III – Las Vegas 6/7
7N Surface Engineering VII – Jubilee 1
7O Materials Tribology VII – Jubilee 2
7P Materials Tribology/Nanotribology Joint Session II:
   Mechanics and Tribochemistry at the Nanoscale – Jubilee 3

Technical Sessions (1:30 – 5:30 pm)
8B Lubrication Fundamentals VIII: Modeling – Bronze 2
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Beverage Breaks are scheduled at 10 am and 3 pm daily.

THURSDAY BUSINESS MEETINGS

8M • Las Vegas 6/7 – Condition Monitoring IV (3:30 – 4:40 pm)
   Condition Monitoring Business Meeting
8N • Jubilee 1 – Surface Engineering VIII (4 – 5 pm)
   Surface Engineering Business Meeting
PARTICLE COUNTS
FOR INDUSTRIAL FLUIDS

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Exhibit Hours

Monday (Noon – 5 pm)  
Exhibitor Appreciation Hour (3 – 4 pm)  
Evonik Raffle (3:30 pm). You must be present to win.

Tuesday (9:30 am – Noon) & (2 – 5:30 pm)  
Closed for Presidents Luncheon (Noon – 2 pm)  
Exhibitor Appreciation Hour (3 – 4 pm)

Wednesday (9:30 am – Noon)  
The exhibition is in the Bally’s Event Center.
Bally’s Hotel and Casino
Jubilee Tower

2nd Floor

3rd Floor
### 71st STLE Annual Meeting & Exhibition • May 15-19, 2016 • Las Vegas, Nevada (USA)

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**Note:** This is a partial listing of exhibitors, and the full map is available for viewing at the event.
Now fit STLE’s Entire 2016 Annual Meeting Schedule—in the Palm of Your Hand!

Available Now: STLE Annual Meeting App

71st STLE Annual Meeting & Exhibition
Bally’s Las Vegas Hotel & Casino
Las Vegas, Nevada (USA)

STLE’s Annual Meeting offers so much programming that keeping track of what’s happening when and where can be a challenge. Our new mobile app lets you plan your itinerary, schedule appointments and stay on top of fast-breaking meeting updates every minute of the day. Download the app—and don’t miss a thing!

STLE’s 2016 Annual Meeting mobile app lets you track, schedule and connect with:

- 500 technical session abstracts—push a button and it’s on your itinerary!
- Paper presenters—easily find your favorite authors
- 12 education courses
- 100-exhibitor trade show
- Special events and networking opportunities
- Floor plans of Bally’s and exhibition
- 1,600 other attendees
- Meeting sponsors
- Local dining
- Meeting updates—stay on top of late-breaking news.

Download the app—and don’t miss a thing!

You can acquire the app four different ways:

1. Download at: www.tripbuildermedia.com/apps/stle
2. Scan the QR code on this page
3. Download from The App Store (Apple products)
4. Download from The Play Store (Android products)

Sponsored by Sea-Land Chemical
General Information and Policies

71st STLE Annual Meeting & Exhibition • May 15-19, 2016 • Las Vegas, Nevada (USA)

Exhibit Hours

Monday (Noon – 5 pm)
Exhibitor Appreciation Hour (3 – 4 pm)
Evonik Raffle (3:30 pm). You must be present to win.

Tuesday (9:30 am – Noon) & (2 – 5:30 pm)
Closed for Presidents Luncheon (Noon – 2 pm)
Exhibitor Appreciation Hour (3 – 4 pm)

Wednesday (9:30 am – Noon)
The exhibition is in the Bally’s Event Center.

REGISTRATION INFORMATION

Attendees may register beginning on Saturday, May 14, from Noon to 6 pm at the Grand Salon (located in Bally’s Indigo Tower). The STLE registration desk is open daily thereafter through Thursday beginning at 7 am.

Registration for the annual meeting entitles you to attend the technical sessions, Welcoming Party on Monday evening, Presidents Luncheon on Tuesday afternoon, and the trade show Monday through Wednesday and most other sanctioned annual meeting events.

Presidents Luncheon guest tickets are $50 (two tickets are free to STLE Corporate Members) and can be purchased at the registration desk at the Grand Salon.

Attendance at business meetings of technical committees and industry councils is open to anyone who is registered for the meeting. See condensed schedule (pgs. 5-6) for time and location of individual technical committee and industry council meetings.

ANNUAL MEETING AND EDUCATION COURSE POLICIES

• All attendees must register.
• A badge is required for admittance to any session or education course.
• Education course registration includes admittance to the selected education course or courses, all technical sessions and admittance to the trade show.
• Handouts are not permitted in any technical session.
• Handouts will be given to education course attendees.
• Registration is not necessary to attend the trade show.

RECORDING POLICY

Audio or video recording is not permitted in any of the annual meeting technical sessions or Commercial Marketing Forum presentations. Audio recording is permitted in the education courses with advance permission of the instructor. No video of any kind is permitted in the education courses.

PHOTO POLICY

STLE’s official photographer is taking photographs of technical sessions, education courses, social events and the trade show on Monday and Tuesday. These images will be used in print materials promoting STLE’s 2017 Annual Meeting & Exhibition at the Hyatt Regency in Atlanta. If you do not want your photo to appear in these materials, please step out of the picture frame or advise the photographer after your photo is taken so they can delete the image.

CELLULAR TELEPHONES

In order to not disturb speakers or follow attendees, please keep cellular telephones on vibrate and leave the room to talk.

FUTURE STLE MEETING DATES

• STLE Tribology Frontiers Conference
  Nov. 13-15, 2016 – The Drake Hotel Chicago
  Chicago, Illinois
• STLE 72nd Annual Meeting & Exhibition
  May 21-25, 2017 – Hyatt Regency Atlanta
  Atlanta, Georgia
• STLE 73rd Annual Meeting & Exhibition
  May 20-24, 2018 – Minneapolis Convention Center with Minneapolis Hilton and Hyatt Regency Minneapolis
  Minneapolis, Minnesota
• STLE 74th Annual Meeting & Exhibition
  May 19-23, 2019 – Omni Nashville Hotel
  Nashville, Tennessee
• STLE 75th Annual Meeting & Exhibition
  May 3-7, 2020 – Hyatt Regency Chicago
  Chicago, Illinois
EMEROX® 1199 is the effective, readily available alternative diacid corrosion inhibitor for your water-based metalworking fluids.

Emery Oleochemicals has been advancing natural-based chemicals since 1840. In our continued commitment to provide innovative bio-lubricant solutions, we are proud to introduce our newest product with outstanding performance in metalworking applications. EMEROX® 1199 when formulated as an amine salt offers proven rust protection and hard water compatibility to help protect your customer’s investment.

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CREATING VALUE | www.emeryoleo.com
Special Events and Networking

71st STLE Annual Meeting & Exhibition • May 15-19, 2016 • Las Vegas, Nevada (USA)

**GOLF TOURNAMENT: LAS VEGAS NATIONAL GOLF COURSE**
Sunday, May 15
1 pm shotgun (arrive at noon for scheduling and practice)

$120 (includes green fees, golf cart rental, range balls, box lunch and one drink ticket at the 19th Hole. Clubs can be rented for $30. No transportation is provided.)

The National, as it’s usually called, has a long history in the Las Vegas Valley. Just after completion in 1961, the National, then called the Stardust Country Club, hosted its first professional golf event, the LPGA Championship. Over the years, the National has played host to celebrities from around the world. Professional athletes, including members of the NFL, NBA, NASCAR and PBA have held events here. The course, with its mature landscaping and proximity to the Las Vegas Strip, make it a truly unique and historic site.

**HOOVER DAM TOUR**
Sunday, May 15 (1 – 5 pm)
$120 (includes transportation, guide, tour and box lunch)

Visit one of the most inspiring man-made wonders of the world. Hoover Dam is the gateway to beautiful Lake Mead, the largest reservoir in America. This engineering marvel will be sure to amaze all of its visitors. Your guide will provide visitors with facts about Las Vegas and points of interest as you embark on your 45-minute journey to Hoover Dam. You will enjoy spectacular views of the entire Las Vegas Valley as you wind through the mountains to your destination. Once at the Dam, you will be invited to take an in-depth tour of this mighty wonder. Your guide will take you through the inside of the Dam and provide interesting facts about the facility. You will learn how it was built and how the Dam provides services today. In addition, the new and improved Visitors Center provides a breathtaking view of the Dam and the Black Canyon below, where the mighty Colorado River starts its journey.

**EARLY CAREERIST NETWORKING EVENT**
Sunday, May 15

This year’s Early Careerist Networking Event is 7-9 pm in the Liaison Lounge at Bally’s Las Vegas. Come join other students and early careerists, as well as other STLE members for an evening of networking and great food. If you would like more information, please stop by the STLE Registration Desk in the Grand Salon.

**SPEAKERS BREAKFAST**
Monday through Thursday, May 16-19
(7 – 8 am) – Platinum

Lead authors and course presenters are invited to meet with Session and Paper Solicitation Chairs for a continental breakfast on the days of their presentations. This is a great time to review the session schedule and note any last-minute changes. Speakers should plan on attending.

**STLE HOSTS STEM PROGRAM FOR HIGH SCHOOL STUDENTS**
Monday, May 16
(9 am – Noon) – Bally’s Event Center

During STLE’s 2016 Annual Meeting, the society is hosting high school students for its 4th Annual STEM Tribology Camp. Students, and their teachers, will have the opportunity to see demonstrations and participate in hands-on experiments, led by engineers and scientists, to learn about areas of research within the fields of tribology and lubrication engineering such as friction, viscosity, wear, and grease.

STLE’s goal is to reach high school students who have an interest in STEM (science, technology, engineering and mathematics) and to educate them about future career opportunities in the fields of tribology and lubrication engineering.
Special Events and Networking

71st STLE Annual Meeting & Exhibition  •  May 15-19, 2016  •  Las Vegas, Nevada (USA)

OPENING GENERAL SESSION
Monday, May 16
(10:30 am – Noon) – Platinum

STLE honors many of its most distinguished volunteers and achievers. You’ll also hear a presentation from Dr. Andrew Randolph, technical director for Earnhardt-Childress Racing (ECR) Engines, titled “Lubrication Challenges in an 850-hp NASCAR Sprint Cup Engine.”

WELCOMING PARTY
Monday, May 16
(6:30 – 8 pm) – Platinum

This is the annual meeting’s central networking event and a way for you to reconnect with old friends while making new ones. Since people come to STLE’s Annual Meeting & Exhibition from around the world, this truly is an international event. Relax, socialize and add to your list of professional contacts through this outstanding networking event. The Welcoming Party is a “can’t miss” annual meeting tradition.

PRESIDENTS LUNCHEON AND STLE 71ST ANNUAL BUSINESS MEETING
Tuesday, May 17
(Noon – 2 pm) – Platinum

The annual meeting’s major business function draws virtually all attendees for a two-hour event honoring STLE’s incoming and outgoing presidents, award winners and top volunteers. Come honor 2015-2016 President Martin Webster with ExxonMobil Research & Engineering and 2016-2017 President Ali Erdemir with Argonne National Laboratory. Tickets to the luncheon are included with annual meeting registration and free to Corporate Member representatives (two tickets) and students. Additional tickets may be purchased for $50 per person at the STLE Registration Desk in the Grand Salon.

NLGI CERTIFICATION EXAM
Monday, May 16
(10 am – Noon) – Skyview 4

NLGI’s Certified Lubrication Grease Specialist (CLGS) program identifies those individuals who have true expertise in lubricating greases. NLGI is proud to announce that the CLGS will be offered during STLE’s 2016 STLE Annual Meeting. Advanced registration is required with NLGI to take the exam. The exam starts promptly at 10 am and takes approximately two hours to complete.

STLE CERTIFICATION EXAMS
Thursday, May 19
(9 am – Noon) – Palace 3

All four exams – Certified Lubrication Specialist, Oil Monitoring Analyst I and II and Certified Metalworking Fluids Specialist – are conducted concurrently. Must be registered for the exams in advance, however, onsite registration is available on a limited basis. For more information, stop by the STLE Registration Desk in the Grand Salon. Registration and sign-in starts at 8:30 am. The exams start promptly at 9 am and takes approximately three hours to complete.

Fees:
•  First exam: $380/STLE member, $510/Non-member
•  Retake exam: $190/STLE member, $255/Non-member

STAY CONNECTED AT THE ANNUAL MEETING AND TWEET #STLE2016

If you’d like to be more involved during the annual meeting and share information with fellow attendees, STLE encourages you to use Twitter to tweet noteworthy sessions, photos, questions and other valuable resources. We’re also encouraging exhibitors, sponsors and companies to use it as a way to share useful information with attendees. Log on to Twitter (www.twitter.com) and just tweet using the #STLE2016 hashtag. And be sure to follow STLE’s twitter handle (@STLE_Tribology) for the latest updates throughout the week regarding the annual meeting.
Education Program Synopsis

The 2016 STLE Annual Meeting & Exhibition features 12 education courses offered on two days of the conference: Sunday, May 15, and Wednesday, May 18. If you have not yet signed up for a course but would like to, please go to the STLE Registration Desk at the Grand Salon (located in Bally’s Indigo Tower) to check on availability.

Note: Courses start at 8 am and end at 5 pm, but please check the errata included in your registration bag to verify. Some times might change slightly.

SUNDAY, MAY 15

• Advanced Lubrication 301: Advanced Additives (NEW!)  
• Basic Lubrication 101: Lubrication Fundamentals  
• Condition Monitoring 101  
• Gears 101: Fundamentals of Gears  
• Metalworking Fluids 130: Metal Treatment Chemical  
• NLGI Grease 101 (Presented in cooperation with NLGI)  
• Synthetic Lubricants 203: Non-Petroleum Fluids & Their Uses

ADVANCED LUBRICATION 301: ADVANCED ADDITIVES

Course Chair: Galen Greene, BASF Corp.
Advanced Lubrication 301 covers the molecular structures and chemistries of lubricant additive types. Additives examined will include antioxidants, rust inhibitors, detergents, dispersants, antiwear additives, extreme pressure additives, friction modifiers and rheology and viscosity modifiers.

Modules and Instructors include:
• Antioxidants and Rust Inhibitors: Mary Dery, BASF Corp.  
• Detergents and Dispersants: Anil Agiral, Chevron Oronite  
• Extreme Pressure and Friction Modifiers: Gene Scanlon, BASF Corp.  
• Rheology and Viscosity Modifiers: Sona Slocum, The Lubrizol Corp.

BASIC LUBRICATION 101: LUBRICATION FUNDAMENTALS

Course Chair: Dan Holdmeyer, Chevron Lubricants
Basic Lubrication 101 is primarily for the person entering the lubrication field who needs a broad introduction to the field of lubrication, lubrication principles and lubricating materials. This course is also for individuals not directly involved but who need a broad overview of lubricants and basic lubricating components. This course does not require a formal scientific degree or background, although many technical terms and concepts are covered. Experienced people attend the course to be kept up to date on the latest developments, especially in those areas not directly related to their job function or area of expertise. Thus, Basic Lubrication 101 is usually attended by a broad cross section of people such as technical, technical service, sales, marketing, manufacturing, maintenance and managers who in some way are involved in the industry.

Modules and Instructors include:
• Base Oil Fundamentals: Jim Arner, Pirr Tribology Solutions  
• Additives: Chris Schmid, The Lubrizol Corp.  
• Lubrication Fundamentals: Dan Holdmeyer, Chevron Lubricants  
• Fundamentals of Hydraulics: Nathan Knotts, Chevron  
• Lubricant Test Methods: Mike Holloway, ALS Tribology  
• Synthetics: Ken Hope, Chevron Phillips Chemical Co. LP

CONDITION MONITORING 101

Course Chair: Jack Poley, Condition Monitoring International
Condition Monitoring 101 is targeted to individuals who are new to Condition Monitoring (CM), helping to prepare them to be effective participants in CM processes in a variety of roles. CM 101 begins with justification for condition-based monitoring, followed by an introduction to historically established maintenance strategies, providing understanding of the differences and benefits of each, continuing with an overview of the steps to implement and execute a program and concludes with instrumentation and test methods for Condition Monitoring.

Modules and Instructors include:
• Condition Monitoring Technologies: Khalid Malik, Ontario Power Generation  
• Committing to and Managing an ISFA Program; Evaluating Your Program: Evan Zabawski, Consultant  
• Fluid Contamination and Degradation Tests for Condition Monitoring: Heather Vercillo, TestOil
GEARS 101: FUNDAMENTALS OF GEARS

Course Chair: Toby Hlade, ExxonMobil Lubricants & Specialties

Gears 101 is designed to provide a general understanding of industrial gearing. This course was prepared as a guide for the user to establish a base knowledge of gears, supporting components, lubricants, condition monitoring, wear modes and failure analysis methodology.

Modules and Instructors include:

• Gear Function; Gear Terminology; Action Between Gear Teeth; Gear Tooth Film Formation: Kurt Thompson, ExxonMobil Lubricants & Specialties
• Gear Manufacturing; Gearbox Supporting Components: Dave Pelletier, ExxonMobil Fuels & Lubricants
• Factors Affecting Lubrication; Lubricant Characteristics; Oil Requirements and Tests: David Scheetz, ExxonMobil Lubricants & Specialties
• Gear Wear Patterns; Failure Mode and Effects Analysis; Gear Condition Monitoring; Gear Root Cause Failure Analysis: Toby Hlade, ExxonMobil Lubricants & Specialties

METALWORKING FLUIDS 130: METAL TREATMENT CHEMICAL

Course Chair: Frederick Passman, BCA, Inc.

While processing parts using metalworking fluids, there is a need for treating, cleaning and protecting chemicals and/or coatings. Substrates either are immersed in these chemicals or have them applied during some point of the processing. This course covers heat treating including oil and polymer quenching, cleaning parts and protecting parts from rust and corrosion. Individuals learn the basics of metallurgy as it applies to heat treating and quenching. This course is intended for chemists, engineers, technical support staff and field service technicians working with and using metalworking fluids.

Modules and Instructors include:

• Metal Treating Fluids I and II: John Duggan, DuBois Chemicals, Inc.
• Metal Cleaning Fluids I: Neil Canter, Chemical Solutions
• Metal Cleaning Fluids II: Suresh Patel, Chemetall
• Metal Cleaning Fluids III: Dave Morrison, Castrol Industrial North America, Inc.
• Metal Protecting Fluids I: Dry Films: Richard Butler, Chemtool Inc.
• Metal Protecting Fluids II: Ted McClure, Sea-Land Chemical Co.

NLGI GREASE 101

(Presented in cooperation with NLGI)

Course Chair: Chuck Coe, Grease Technology Solutions, LLC

Grease 101 is a comprehensive overview of all aspects of lubricating grease. Grease formulation components are thoroughly covered, including base oils and the many different thickener types. Manufacturing technologies are reviewed, as well as grease testing significance and methods. This course includes discussion and examples of selecting the proper grease for different industrial and automotive applications.

Modules and Instructors include:

• Introduction to Greases: Chuck Coe, Grease Technology Solutions, LLC
• Base Oils: Valentina Serra-Holm, Nynas AB
• Grease Manufacturing Overview and Open Kettle Manufacture; Grease Manufacturing Contractor/Kettle and Continuous Manufacture: David Turner, CITGO Petroleum Corp.
• Grease Testing: Jaime Spagnoli, ExxonMobil Research & Engineering
• Grease Selection: Paul Shiller, University of Akron
• Industrial Applications: Glenn Lutz, Dow Corning Corp.
• Automotive Applications: Gareth Fish, The Lubrizol Corp.
• Application Problem Solving: Alex Dabrowski, Total Lubricants USA, INC.

SYNTHETIC LUBRICANTS 203: NON-PETROLEUM FLUIDS & THEIR USES

Course Chair: Thomas Blunt, Krytox Performance Lubricants

Synthetic Lubricants 203 is designed primarily for formulators and users of lubricating materials. This course provides an overview of non-petroleum-based lubricants, their comparison to each other and to petroleum oil. Each section covers the chemistry, strength and weaknesses of each material and basic application.

Modules and Instructors include:

• Introduction to Synthetic Fluids: Michael T. Costello, BASF Corp.
• Polyalkylene Glycols: Martin Greaves, Dow Europe GmbH
• Silicones: Glenn Lutz, Dow Corning Corp.
• Polyalphaolefins: Ken Hope, Chevron Phillips Chemical Co. LP
• Esters: Gene Zehler, BASF Corp.
• Fluorocarbons: Thomas Blunt, Krytox Performance Lubricants
• Alkylated Aromatics: Kyle Lewis, ExxonMobil Chemical Co.
• Phosphates: Sal Rea, Anderol Co., Inc.
Education Program Synopsis

WEDNESDAY, MAY 18

- Advanced Lubrication 302: Advanced Lubrication Regimes (NEW!)
- Automotive Lubrication 202: Gasoline
- Basic Lubrication 102: Basic Applications
- Metalworking Fluids 105: Introduction to Metal Forming Fluids
- Synthetic Lubricants 204: Fluid Formation & Applications

ADVANCED LUBRICATION 302: ADVANCED LUBRICATION REGIMES

Course Chair: Galen Greene, BASF Corp.
This course goes more in-depth on lubrication regimes, wear and wear mechanisms, as well as lubricant failure analysis. Includes a series of lubricant failure analysis case studies on automotive engines, gears and bearings.

Modules and Instructors include:
- Lubrication Regimes: Brendan Miller, Chevron Oronite Co., LLC
- Wear and Wear Mechanisms; Automotive Engines Case Study: Ramoun Mourhatch, Chevron Oronite Co., LLC
- Lubricant Failure Analysis: Walt Huysman, Clark Testing
- Gears Case Study: Toby Hlade, ExxonMobil Lubricants & Specialties
- Bearings Case Study: Paul Shiller, University of Akron

AUTOMOTIVE LUBRICATION 202: GASOLINE

Course Chair: Edward Becker, Friction & Wear Solutions, LLC
Automotive Lubrication 202 provides a comprehensive overview of the various aspects of a typical automotive tribological system, including engine, transmission, driveline and other powertrain components. Lubrication and surface engineering principles will be applied to provide a unified approach to practical automotive powertrain systems.

Modules and Instructors include:
- Principles of the Automotive Engine; The Future of Automotive Propulsion: Edward Becker, Friction & Wear Solutions, LLC
- Automotive Engine and Transmission Hardware Overview: Arup Gangopadhyay, Ford Motor Co.
- Engine Oils: Nicolas Rivera, ExxonMobil Research & Engineering

METALWORKING FLUIDS 105: INTRODUCTION TO METAL FORMING FLUIDS

Course Chair: Richard Butler, Chemtool Inc.
Metalworking Fluids 105 is designed for those involved in developing, working with and using metal forming fluids in the manufacturing environment. This course is very useful for formulators, technical service representatives, shop floor personnel and coolant service managers who need to know more about the fundamental concepts of metal forming fluids. This course is divided into modules covering metal forming operations, metal forming fluid chemistry, metal forming fluid failure mechanisms, controlling contamination and microbial growth, waste treatment and operator acceptance. By the end of the course, participants will have gained a good understanding of metal forming operations, formulation of

BASIC LUBRICATION 102: BASIC APPLICATIONS

Course Chair: Dan Holdmeyer, Chevron Lubricants
Basic Lubrication 102 is an overview of equipment systems (gears, bearings, seals, compressors and engines) and their lubrication requirements, including a module on grease. Like Basic Lubrication 101, this course does not require a formal scientific degree or background, although many technical terms and concepts related to the use of lubricants in various mechanical devices are covered. This course is intended for a diverse group, including people involved in technical service, sales, marketing, manufacturing, maintenance and managers who want to know more about how lubricants work in service. This course assumes fundamental knowledge of lubricants and lubrication principles, as presented in the Basic Lubrication 101 course.

Modules and Instructors include:
- Gears and Coupling Fundamentals: John Hermann, ExxonMobil Fuels & Lubricants
- Grease Fundamentals: Chris Decker, ExxonMobil
- Seals: Hongmei Zhao, The Lubrizol Corp.
- Compressors: Ravi Shah, Chevron Global Lubricants
- Bearings and Lubrication Systems: Paul Shiller, University of Akron
- Automatic Transmission Fluids; Basic Engine: Sam Vallas, Chevron Global Lubricants

Automatic Transmission Fluid: Scott Deskin, Chevron
Surface Texture Measurement and Analysis: Donald Cohen, Michigan Metrology
metal forming fluids, tools for identifying and correcting metal forming fluid failures and waste treatment of metal forming fluids.

**Modules and Instructors include:**

- **Introduction to Processes, Applications and Fluid/Lubrication Requirements; Metal Forming Fluid Failure Mechanisms: Water Quality, Corrosion, Foam, Emulsion Size, Residue and Cleanability:** Richard Butler, Chemtool Inc.
- **Stamping and Blanking; Metal Forming Failure Mechanisms: Lubrication, Concentration Control, Compatibility and Filtration:** Neil Canter, Chemical Solutions
- **Rolling, Forging, Heading, and Wire Drawing:** Ted McClure, Sea-Land Chemical Co.
- **Controlling Contamination and Microbial Growth in Metal Forming Fluids:** Frederick Passman, BCA, Inc.
- **Waste Treatment of Metalworking Fluids:** John Burke, Houghton International Inc.
- **Operator Acceptance – All Instructors**

**SYNTHETIC LUBRICANTS 204: FLUID FORMATION & APPLICATIONS**

**Instructors:** Thomas Blunt, Krytox Performance Lubricants

This course provides an introduction to synthetic lubricant formulations and applications. It compares the use of these synthetic lubricants to petroleum-based products and compares between types of synthetic lubricants. Synthetic Lubricants 204 is a continuation from the Synthetic Lubricants 203 (Non-Petroleum Fluids and their Uses) course, however, attendance of the Synthetic Lubricants 203 course is not a prerequisite.

**Modules and Instructors include:**

- **Industrial Application/Compressors:** Glenn D. Short, BVA Inc.
- **Synthetic Lubricants in Transportation Applications:** Michael T. Costello, BASF Corp.
- **Synthetic Lubricants in Gear Applications:** Kevin Hunter, ExxonMobil Products Technology Deployment
- **Synthetic Lubricants in Food Grade Applications:** Tyler Housel, INOLEX Inc.

**NANOTRIBOLOGY SPECIAL SESSION**

Sunday, May 15 – 1:30-5 pm • Palace 3

The Nanotribology special session is organized by STLE’s Nanotribology Technical Committee. The objective is to provide an opportunity for graduate student researchers, early career scientists and industry professionals to learn, review and discuss fundamentals, as well as the cutting edge of nanotribology. In previous years, topics have included basics to intermediate education on fundamentals of nanotribology, nanotribological characterization techniques and analysis of friction, wear and lubrication at the nanoscale and applications and examples in research and manufacturing.

Participants will learn about nanoscale contact, surface properties such as surface energy, morphology, electrical and thermal conductivity, and hardness and how they affect nanomeasurement, principles of probe-based atomic force microscopes, nanoscale friction and wear fundamentals. In areas of nanomeasurement, pros and cons of the methodology, tool selection strategy, artifacts and data analysis will be discussed. Additional topics that will be covered include applications of nanotribology such as in chemical-mechanical planarization, lubricants and thin films, as well as biomedical applications.

**Instructor: Dr. Hong Liang**

Dr. Liang is a professor of mechanical engineering at Texas A&M University. Her research group has been investigating fundamentals in nanotribology, nanomaterials, nanomanufacturing, and surface engineering. She has authored 14 book chapters and over 160 peer-reviewed journal articles. Dr. Liang has been actively involved with STLE and the tribology community for almost three decades since she was a graduate student. She has served as an associate editor of Tribology Transactions, Tribology International and the Journal of Tribology, and is a former member of STLE’s board of directors. She also previously served as chair of the STLE Annual Meeting Program and Ceramics and Composites Technical Committees. She is a fellow of STLE and ASME.
Keynote Address

Monday, May 16 • 10:30 am – Noon • Platinum

Dr. Andrew L. Randolph
Technical Director, Earnhardt-Childress Racing (ECR) Engines, Welcome, NC

STLE is fortunate to have Dr. Andrew L. Randolph, technical director for Earnhardt-Childress Racing (ECR) Engines, as the keynote speaker for our 71st Annual Meeting & Exhibition.

Randolph received his doctorate in chemical engineering from Northwestern University in 1985, specializing in the combustion properties of alcohol/diesel and alcohol/oil blends. During a 30-year career at General Motors and in NASCAR, his work has ranged from fundamental engine research to mass-production engine development, including Wankel rotaries to Pro Stock drag engines.

Randolph's presentation is titled “Lubrication Challenges in an 850-hp NASCAR Sprint Cup Engine.” Topics include:

- Differences between race engines and production engines
- Energy audit of a NASCAR Sprint Cup Engine, including all rotating and reciprocating losses
- Challenging lubrication regimes (materials, coating, forces)
- Opportunities for improvement.

A strong advocate of applying scientific principles to engine development, Randolph is widely regarded as one of the foremost applied-combustion experts in the world. He has contributed to five NASCAR Cup championships with three different teams.

Since 2008, Randolph has served as technical director for ECR Engines in Welcome, N.C., where he leads a development team that defines the engine architecture for the Chevy engines supplied by ECR to NASCAR and a variety of other racing series. He has authored more than 20 technical publications and received five oral presentation awards from the Society of Automotive Engineers.
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