



# Stanford Center for Position, Navigation and Time



9th Annual PNT Symposium • November 11-13, 2015 • Kavli Auditorium at SLAC

## Schedule

- November 11 — All Day, Student Presentations
- November 12 — All Day, plus Dinner at the Stanford Faculty Club
- November 13 — Morning, plus Lunch

## Hosts

- Simone D'Amico
- Per Enge
- Leo Hollberg
- Mark Kasevich
- Tom Langenstein
- Brad Parkinson
- Jim Spilker

## Invited Speakers

- Brad Parkinson—GNSS, eLoran and Inertials . . .Where are we going?
- Wei Lee—GPS Smart Bombs
- Parimal Kopardekar—Drones and US Airspace
- Gary Cathey—Caltrans and UAS Operations in California
- Lee Boyce—Loon: Balloon-powered Internet for Everyone
- Jin Shi—China's High-speed Railway Application with GNSS
- Mark Stevens—Lunar Laser Communication Demonstration
- Ross Halperin—Tracking Technology and the Corrections System
- Ronny Votel—Geolocation for Skybox Imaging Satellites
- Colonel David Goldstein—AFRL GPS Research & Development
- Fred Jansen—Rosetta: To Escort and Land on a Comet
- Barbara Block—Global Tagging and Tracking of Marine Species using PNT
- Dan Boneh—Location Privacy: Attacks and Defenses
- Frank van Diggelen—First GPS MOOC and Worldwide Lab using Smartphones
- Ed Lu—Sentinel Mission - Protecting Earth from Asteroid Impacts
- Heidi Kuusniemi—Navigating the Arctic Rush
- Surendra Pal—India GNSS Paradigm
- Colonel Gerry Gleckel — Update on the GPS Program

## Sponsors



**Web Site:** <http://scpnt.stanford.edu>  
**Email:** [tom.langenstein@stanford.edu](mailto:tom.langenstein@stanford.edu)  
**Phone:** (650) 823-4906

### SPACE IS LIMITED to 160 Attendees! — RSVP Required



# Stanford's 2015 PNT Challenges and Opportunities Symposium - 'R12'

November 12th & 13th - Kavli Auditorium, SLAC & Stanford Faculty Club

Day / Date	~ Start Time	~mins w/ Q&A	Invited Speaker	Affiliation	Title of Presentation
<b>Thu</b> 11/12/15	8:00am	45	<i>Reception &amp; Coffee Service at SLAC's Kavli Auditorium Lobby</i>		
<b>1</b>	8:45am	15	Holtkamp, Norbert	Deputy Lab Director of SLAC	Welcome & Opening Comments
<b>2</b>	9:00am	45	Parkinson, Brad	Stanford Aero-Astro	GNS, eLoran & Inertials ...Where are we going?
<b>3</b>	9:45am	30	Lee, Wei	Air Force Test Center (AFTC)	GPS Smart Bombs
	10:15am	30	<i>Morning Break</i>		
<b>4</b>	10:45am	30	Kopardekar, Parimal	NASA ARC	Drones and US Airspace
<b>5</b>	11:15am	30	Cathey, Gary	CA Department of Transportation	Caltrans and Unmanned Aircraft System Operations in California
<b>6</b>	11:45am	30	Boyce, Lee	Google	Loon - Balloon-powered internet for everyone
	12:15pm	60	<i>Catered Lunch at Kavli Porch &amp; Panosky Grove</i>		
<b>7</b>	1:15pm	30	Shi, Jin	China Railway Signal & Communication Corp.	China's High-speed Railway Application with GNSS
<b>8</b>	1:45pm	30	Stevens, Mark	MIT Lincoln Labs	Time-of-Flight and Ranging Experiments on the Lunar Laser Communication Demonstration
<b>9</b>	2:15pm	30	Halperin, Ross	NYU's Marron Institute	Tracking Technology and the Corrections System: Can Technology Solve Mass Incarceration?
	2:45pm	30	<i>Afternoon Break # 1</i>		
<b>10</b>	3:15pm	30	Votel, Ronny	Skybox - Google	Geolocation for Skybox Imaging Satellites
<b>11</b>	3:45pm	30	Goldstein, David Col.	USAF AFRL	AFRL GPS Research & Development
<b>12</b>	4:15pm	30	Jansen, Fred	ESA	Rosetta - to escort, and land on a comet
	4:45pm	75	<i>Afternoon Break #2</i>		
	6:00pm	90	<i>Reception and Dinner on campus at Stanford's Faculty Club</i>		
<b>13</b>	7:30pm	30	Block, Barbara	Stanford - Hopkins Marine Station	Global tagging and tracking of Marine Species using PNT technology
<b>Fri</b> 11/13/15	8:00am	30	<i>Reception &amp; Coffee Service in SLAC's Kavli Lobby</i>		
<b>14</b>	8:30am	30	Boneh, Dan	Stanford - Computer Science and EE	Location privacy: attacks and defenses
<b>15</b>	9:00am	30	van Diggelen, Frank	Broadcom and Stanford Aero-Astro	The World's First GPS MOOC and Worldwide Laboratory using Smartphones
<b>16</b>	9:30am	30	Lu, Ed	B612 Foundation	Sentinel Mission - Protecting the Earth from Asteroid Impacts
	10:00am	30	<i>Morning Break</i>		
<b>17</b>	10:30am	30	Kuusniemi, Heidi	Finnish Geospatial Research Institute, Finland	Navigating the Arctic Rush
<b>18</b>	11:00am	30	Pal, Surendra	India - Defense Institute of Advance Technology	India GNSS Paradigm
<b>19</b>	11:30am	45	Gleckel, Gerry Col.	USAF GPS Directorate & AFRL	Update on the GPS Program
	noon	60	<i>Catered Lunch at Kavli Porch &amp; Panosky Grove</i>		

# Stanford's 2015 PNT Symposium - 'R12' - Student Presentations

Wednesday November 11th - Kavli Auditorium, SLAC

Day / Date	~ Start Time	~mins w/ Q&A	Invited Speaker	Affiliation	Title of Presentation
Wed 11/11/15	9:30am	30	<i>Reception &amp; Coffee Service at SLAC's Kavli Auditorium Lobby</i>		
<b>1</b>	10:00am	30	Louis Dressel	Stanford University	Jagr Path Planning
<b>2</b>	10:30am	30	Jinsil Lee	KAIST	Vertical Position Error Bounding for Integrated Sensors to Support Unmanned Aerial Vehicles (UAV)
	11:00pm	15	<i>Morning Break</i>		
<b>3</b>	11:15am	30	Dongyang Xu	Colorado State University	GNSS tracking algorithm to process strong equatorial scintillation signals
<b>4</b>	11:45am	30	Shankar Ramakrishnan	Stanford University	L1C Benefits
<b>5</b>	12:15pm	30	Jordan Larson	University of Minnesota	Generating Empirical Overbounds for PNT Algorithms Using Extreme Value Theory
	12:45pm	45	<i>Catered Lunch at Kavli Porch &amp; Panosky Grove</i>		
<b>6</b>	1:30pm	30	Jeanette Veldman	University of Colorado	Autonomous Onboard Navigation using One-way Radiometric Tracking Data: Filter Design and Model Simplification
<b>7</b>	2:00pm	30	Nate Carson	Auburn University	Detection and Suppression of Spoofing Attacks against GPS Receivers using Signals Processing Techniques
<b>8</b>	2:30pm	30	Yuting Ng	University of Illinois at Urbana-Champaign	Multi-Receiver Vector Tracking
	3:00pm	15	<i>Afternoon Break</i>		
<b>9</b>	3:15pm	30	Bryant Mairs	IntelinAir & recent UC Santa Cruz Graduate	Autonomous Ocean Surface Vessel
<b>10</b>	3:45pm	30	Mike Jamoom	Illinois Institute of Technology	UAV Sense and Avoid systems
<b>11</b>	4:15pm	30	Yang Su	Illinois Institute of Technology	Sensing small-scale ionospheric irregularities with a high-latitude GNSS receiver array
<b>12</b>	4:45pm	30	Josh Sullivan	Stanford University	Angles-only autonomous rendezvous navigation to a space resident object
	5:15pm	-	<i>Wrap Up Discussion (SCPNT Faculty, Staff and Affiliates)</i>		

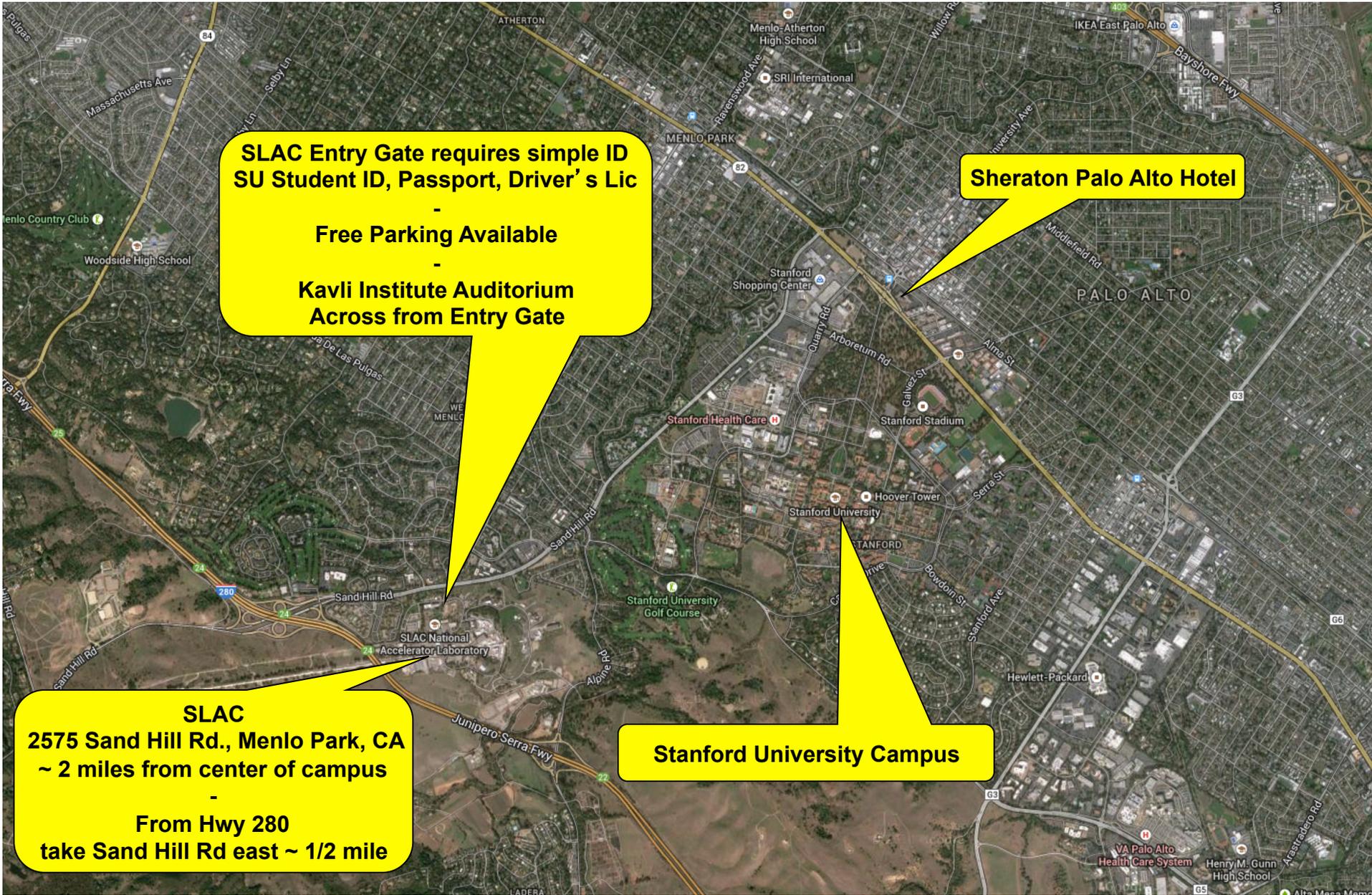
## Stanford's 2015 PNT Symposium Attendee List ...as of 10/28/15

Individual	Affiliation	Individual	Affiliation
Akos, Dennis	Univ. Colorado, Stanford	Lee, Rich	iPosi, Greenword Telecommunications
Alexander, Ken	FAA	Lee, Wei	Air Force Test Center, Edwards AFB
Ascarrunz, Huascar	Harris	LeMaster, Ed	Lockheed Martin
Barrows, Andy	Stanford	Li, Ken	Boeing
Bencze, Bill	Coherent Navigation	Litton, James	Litton Consulting Group, Inc.
Berkeland, Dana		Lo, Sherman	Stanford
Bevly, Dave	Auburn University	Lollock, Rita	Aerospace Corp.
Blanch, Juan	Stanford	Lorell, Ken	Lockheed Martin - retired
Block, Barbara	Stanford - Hopkins Marine	Lu, Ed	B612 Foundation
Boneh, Dan	Stanford - Computer Science and EE	Luo, Ming	Stanford
Boxwell, Catherine	Stanford	Mairs, Bryant	IntelinAir & recent UC Santa Cruz Graduate
Boyce, Lee	Google	Martin, Scott	Auburn University
Braisted, Paul	Trimble	McBurney, Paul	gopherHush Corp
Bruner, Phil	Northrop Grumman	McMillin, Emily	Stanford
Buchman, Sasha	Stanford	Melyappan, Subbu	NextNav
Bushnell, Glen	Boeing	Miller, Isaac	
Calabro, Michael	Booz Allen Hamilton Engineering Services, LLC	Miller, Mikel	AFRL
Carson, Nate	Auburn University	Mitelman, Sasha	AMM Consulting
Cate, Nolan	NASA ARC	Montgomery, Paul	Trimble
Cathey, Gary	CA Department of Transportation	Moran, Stephen	Raytheon
Chen, Yu Hsuan	Stanford	Morgan, Jamie	Northrop Grumman
Christiano, Paul	Boeing	Morton, Jade	Colorado State University
Clark, Ashley	Stanford	Muhfelder, Barry	Stanford
Cobb, Stewart	Satelles	Mullin, Rich	Thales
Cohen, Clark	PNT-holdings	Myers, Jason	Ball Aerospace
Conschaffer, Mike	Harris	Narins, Mitch	FAA
Cooper, John	Farella Braun + Martel LLP	Ndili, Awele	Ndili Technologies, Inc.
Crabill, Carl	Lockheed Martin - Retired	Ng, Yuting	University of Illinois at Urbana-Champaign
Czopek, Frank	Consultant	Nguyen, Paul	Org: NCD
D'Amico, Simone	Stanford AA	Nichols, Jon	Google
Darland, Jeffrey	Raytheon	Noble, Fergus	Swift Navigation
Davidoff, Larry	Boeing	Nowitzky, Tom	Globalstar
DeLorenzo, David	Polaris Wireless	O'Connor, Mike	iKare
DeMont, Jason	KBSO Law	Olsen, Dave	FAA
Dewell, Larry	Lockheed Martin	Opshaug, Guttorm	Qualcomm
Do, Ju-Yong	Qualcomm	Osburn, Scot	Aerospace Corporation
Dressel, Louis	Stanford University	Pal, Surendra	India - Defense Institute of Advance Technology
Eglington, Mike	Google	Park, Young Shin	Stanford
Eisenman, Robert	NEWCO, SafeKey Technology	Parkinson, Brad	Stanford Aero Astro
Elkaim, Gabe	UCSC	Pendleton, Rand	Sportvision
Enge, Elaine	Stanford	Perkins, Adrien	Stanford
Enge, Per	Stanford	Phelts, Eric	Stanford
Fiebig, Uwe	DLR	Powell, Dave	Stanford
Fitzgerald, Alissa	A.M. Fitzgerald & Associates, LLC	Powell, Thomas	Aerospace Corp.
Fruehauf, Hugo	The Hugo Fruehauf Company	Rahaim, Christopher	FAA
Gao, Grace	Univ. of Illinois	Ramakrishnan, Shankar	Stanford University
Garin, Lionel	Qualcomm	Reichel, Jack	Reichel Technology
Gleckel, Gerry Col.	USAF GPS Directorate	Reid, Tyler	Stanford
Goel, Ashish	Stanford	Rispoli, Francesco	Ansald-sts
Goldstein, David Col.	USAF AFRL	Rolli, Joe	Harris
Green, Gaylord	NavAstro	Schlatter, Ed	Raytheon
Gromov, Konstantin	Google	Schneckenburger, Nicholas	DLR - Stanford
Guild, Liane	NASA	Schreier, Louis	UC Berkeley - Deutsche Telekom
Haddad, Ranwa	Aerospace Corporation	Segal, Ben	Stanford
Hall, Dennis	Northrop Grumman	Sena, Randy	Aerospace Corporation
Halperin, Ross	NYU's Marron Institute	Shao, Charles	Center for High-speed Railway Technology, Tsinghua University
Hansen, Andrew	DOT/RITA/Volpe Center	Shi, Jin	China Railway Signal & Communication Corp.
Hanson, John	CrossTrac Engineering	Siegel, Robert	Stanford
Harbaugh, Dwight	Stanford - SLAC	Skinner, Doug	Boeing
Hatta, Tarun	Polaris Wireless	Sloan, Susan	Northrop Grumman
Hinnant, Hank	Boeing	Spilker, Jim	Stanford
Hogan, Erik	Space Systems Loral	Stevens, Mark	MIT Lincoln Labs
Hollberg, Leo	Stanford	Stockwell, Walter	Trimble
Holtkamp, Norbert	SLAC	Stoner, Richard	Draper Labs
Howley, Brian	Lockheed Martin	Su, Yang	Illinois Institute of Technology
Hua, Quyen	PAQCom	Sullivan, Josh	Stanford University
Humphreys, Todd		Sun, Jerry	FLY with ARTS
Iannucci, Bob	Carnegie Mellon University West	Tadros, Al	Space Systems Loral
Ingraham, Ed	NASA Ames	Tam, Man	Speakeasy
Jackson, Robert	Lockheed Martin	Tom, Theresa	Stanford
Jamoom, Mike	Illinois Institute of Technology	Tournear, Derek	Harris
Janeski, John	Aerospace Corporation	Turetzky, Greg	Intel
Jansen, Fred	ESA	van Diggelen, Frank	Broadcom and Stanford
Joerger, Mathieu	Illinois Institute of Technology	Veldman, Jeanette	University of Colorado
Johnson, Michael	Northrop Grumman	Vilaboy, Mike	Harris
Karunanayake, Dhar	Qualcomm	Votel, Ronny	Skybox - Google
Kasevich, Mark	Stanford	Walsh, Tim	Globalstar
Keegan, Richard	John Deere	Walter, Todd	Stanford
Klinger, Gil	Harris	Weida, George	Moog
Kohstall, Christoph	Stanford	West, Sharon Lindsey	GPS Lab Alumni
Kopardekar, Parimal	NASA ARC	Woo, Andy	Space Systems Loral
Kuusniemi, Heidi	Finnish Geospatial Research Institute, Finland	Wright, Robert	Lockheed Martin
Kyger, David	Booz Allen Hamilton Engineering Services, LLC	Xu, Dongyang	Colorado State University
Lai, Peter	Globalstar	Yang, Chun	Sigtem Technology
Landon, James	Raytheon	Yu, Wei	NavCom Technology Inc - A John Deere Company
Lange, Art	Trimble	Zhang, Shiwen	Stanford
Langenstein, Tom	Stanford	Zhi, Sean	Trimble
Larson, Jordan	University of Minnesota	Zimmerman, Kurt	Trimble
Ledvina, Brent	Coherent Navigation	Zorn, Alan	Stanford
Lee, Jinsil	KAIST		



# Stanford's PNT Symposium

November 11<sup>th</sup>-13<sup>th</sup>, 2015



**SLAC Entry Gate requires simple ID**  
SU Student ID, Passport, Driver's Lic

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**Free Parking Available**

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**Kavli Institute Auditorium**  
Across from Entry Gate

**Sheraton Palo Alto Hotel**

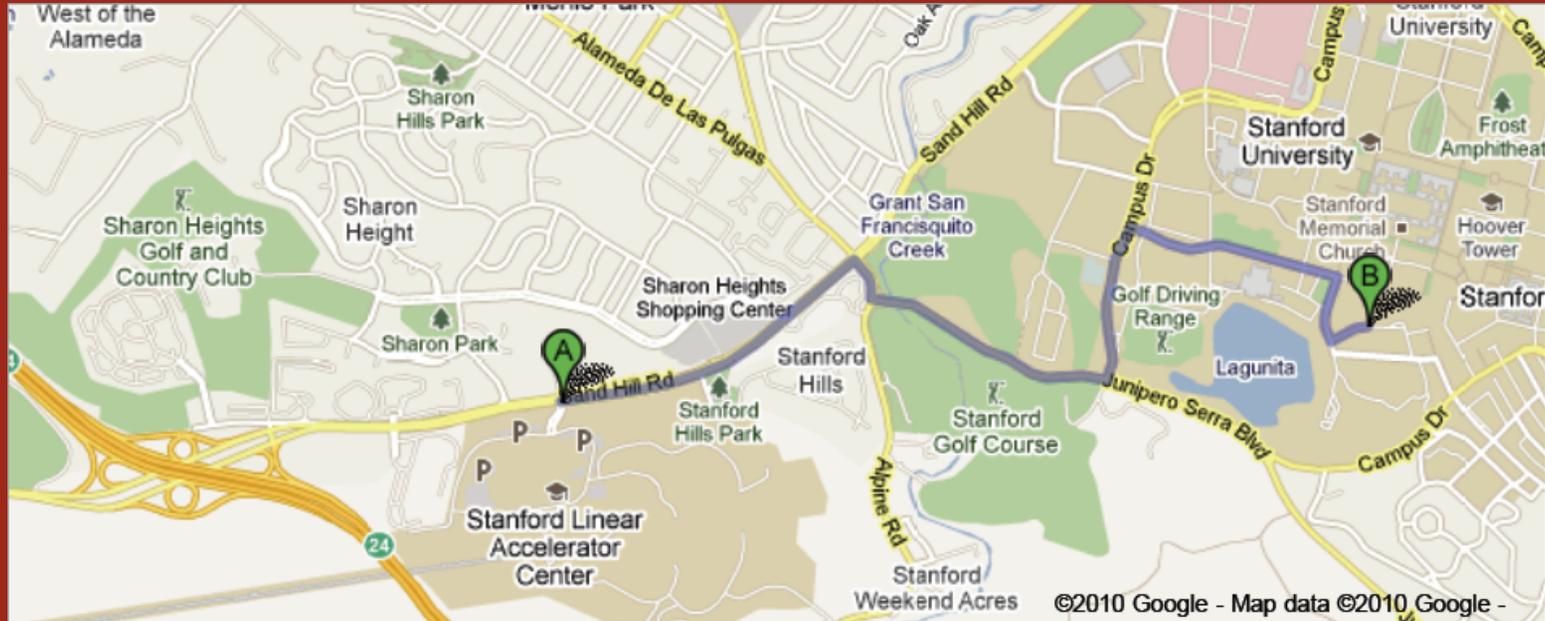
**SLAC**  
2575 Sand Hill Rd., Menlo Park, CA  
~ 2 miles from center of campus

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From Hwy 280  
take Sand Hill Rd east ~ 1/2 mile

**Stanford University Campus**

# Directions from SLAC to Faculty Club



## A Loop Rd

1. Head east on Loop Rd

Restricted usage road

66 ft

2. Turn left toward Sand Hill Rd

Partial restricted usage road

420 ft

3. Turn right onto Sand Hill Rd

0.7 mi

4. Turn right onto Santa Cruz Ave

0.1 mi

5. Take the 1st left onto G5/Junipero Serra Blvd

0.6 mi

6. Turn left onto Campus Drive

0.3 mi

7. Turn right onto Santa Teresa St

0.5 mi

8. Turn right onto Lomita Dr

0.1 mi

9. Turn left onto Lagunita Dr

Destination will be on the left

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## B Stanford Faculty Club 439 Lagunita Drive Stanford, CA 94305