



FORCES All Hands Meeting

June 9-10, 2016





FORCES

Program Highlights

Larry Rohrbough, UC Berkeley

June 9, 2016



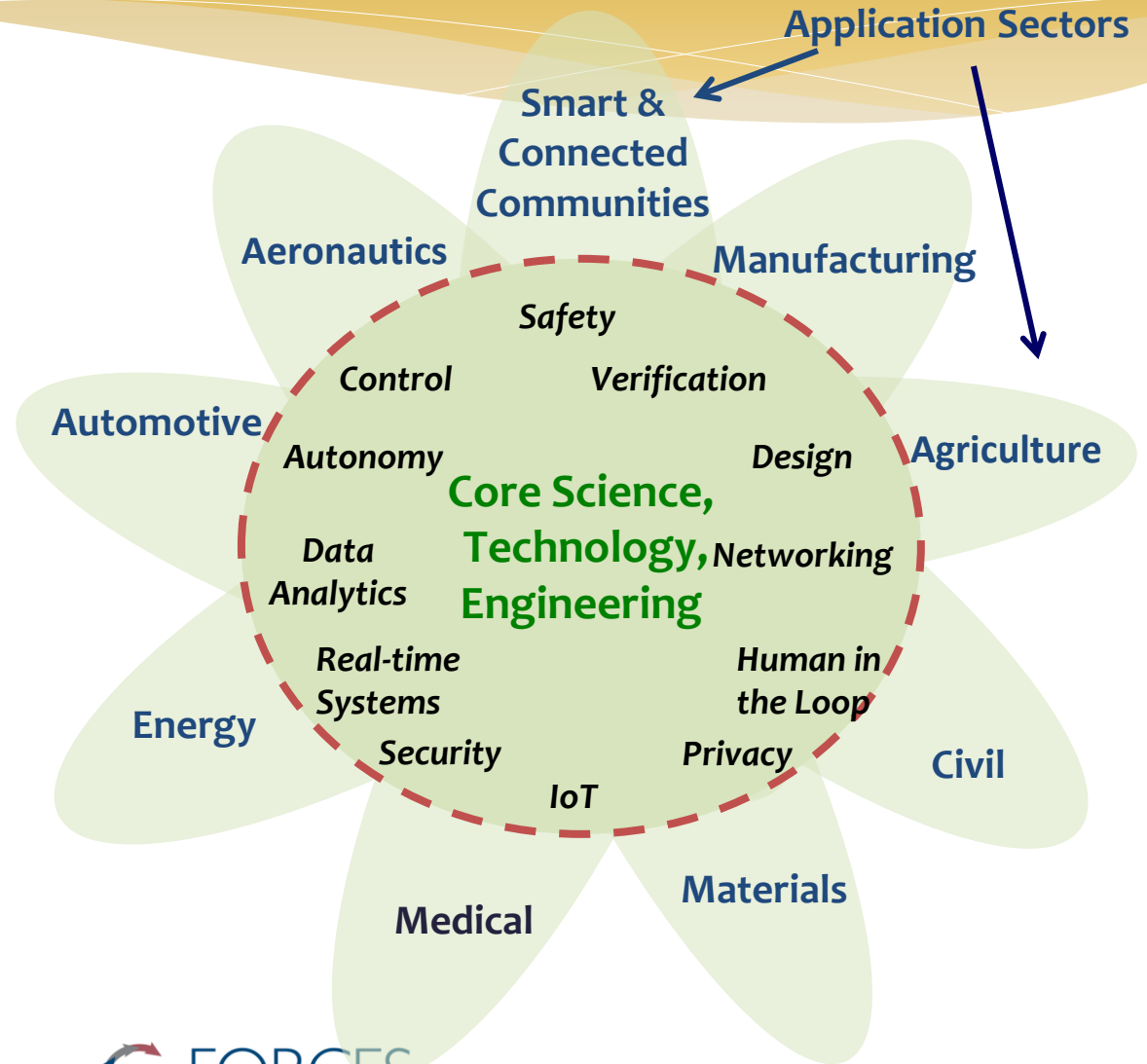
FORCES & NSF CPS Research Model

- * FORCES Domains

- * Energy
- * Ground transportation
- * Air transportation
- * Smart cities

- * FORCES Science

- * Robust control
- * Reliability & safety
- * Human-CPS
- * Security & privacy
- * Systems & analytics
- * Tools & Testbed



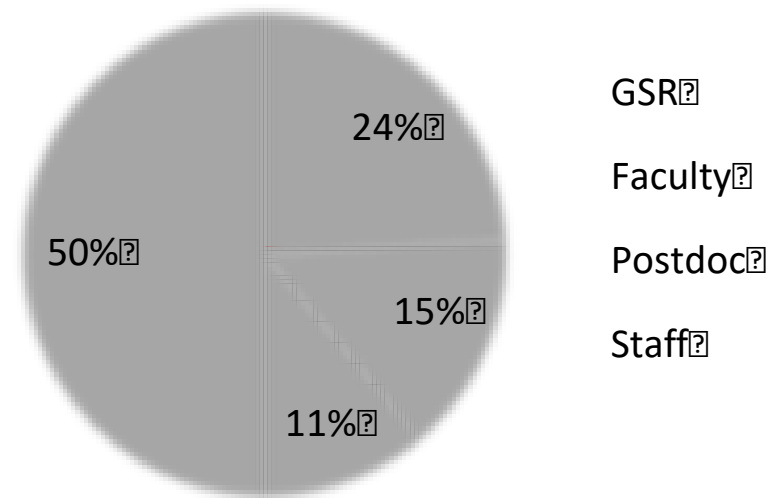
The FORCES Team

- * Total Participants = 54
 - * Graduate Students = 27
 - * Faculty = 13
 - * Post Docs = 8
 - * Staff = 6

- * Demographics

- * Female = 22%
- * URM = 4%
- * U.S. Persons = 56%

FORCES Personnel (all institutions)



The FORCES Team (cont.)

New GSRs / Postdocs / Faculty / Staff

Francois Belletti (Bayen)

Eric Mazumdar (Sastry)

George Netscher (Bayen)

Richard Shin (Song)

Datong Zhou (Tomlin)

Sajal Bhatia (Koutsoukos)

Istvan Madari (Sztipanovits)

Yevgeniy Vorobeychik (faculty)

Karthik Gopalakrishnan
(Balakrishnan)

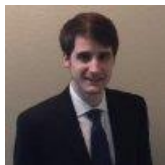
Ignacio Olguin (Amin)

The FORCES Team (cont.)

Current (& Almost) Project Alumni



Kevin Chen
Ph.D. Computer Science, Berkeley



Michael Kasperski
M.S., Astronautics and Aeronautics, MIT



Lina Sela Perelman
Postdoc, MIT



Insoon Yang
Postdoc, MIT



Recent FORCES Highlights

- * Evolution of new service models and data markets for societal-scale energy and transportation CPS, including data as a commodity, sharing economy services, data disaggregation and privacy, service contracts, queuing game framework, and infrastructure evolution.
- * Deployment (placement), scheduling, and operations of resource-constrained monitoring devices (water distribution networks).
- * Optimizing detection thresholds for (interdependent) CPS intrusion detection systems in the face of strategic attacks.
- * Economic and policy models (e.g., carbon tax) to achieve equilibrium for energy producer investment/transition to clean energy technologies.
- * Routing games (models) for congestion in traffic networks (e.g., transportation, communications) that are robust to stochastic perturbations support heterogeneous learning.

Recent FORCES Highlights (cont.)

- * Resilient CPS (RCPS) testbed for evaluation and experimentation: spacecraft, vehicle controls, ground transportation, rail transportation, power transmission & distribution.
- * Methods and tools for making security part of system-level co-design (function, performance, timing, security).
- * Game theoretic models for assessing (and managing) risks in large-scale interdependent CPS taking into account various types of attacks plus costs and tradeoffs to secure.
- * Resilience of networked CPS, specifically air traffic management systems, models of delay dynamics, and measure of resilience via delay persistence.

Recent FORCES Highlights (cont.)

- * Institute for Pure and Applied Mathematics (IPAM), UCLA
 - * Summer School on *Games and Contracts for Cyber Physical Security*, July 2015 (Schwartz/Amin/Ozdoglar)
 - * Long Program on *New Directions in Mathematical Approaches for Traffic Flow Management*, Sept. – Dec. 2015 (Bayen)
- * Institute for Mathematics and its Application (IMA), U. Minnesota
 - * Workshop on *Analysis and Control of Network Dynamics*, Oct. 2015 (Ozdoglar)
- * MIT Freshmen Education Module
 - * Module on *Security Games on Infrastructure Networks* (Amin/Perelman/Dahan)
- * Economics and CPS Mini-Course
 - * Weekly seminar on *Economics for CPS Researchers*, Spring 2016 (Schwartz)
 - * Advertised via CPS-VO; FORCES and others participated

Recent FORCES Highlights (cont.)

- * ACCESS-FORCES Workshops on Cyber-Physical Systems
 - * KTH, Stockholm, Oct. 2015
 - * Focus on Communications, Energy and Transportation Systems, Security, and Education
 - * Follow-on workshop being planned with industry (ABB, Ericsson, Saab, Modelon, ...)
- * CYBEAR GenCyber Summer Camp
 - * Expansion of 2015 pilot camp: longer + more students
 - * 2016 camp emphasis on CPS (energy, transportation, smart cities)
 - * Curriculum specialist
 - * Evaluations to measure impacts of education interventions on student knowledge, engagement, and interest in topics

FORCES Work Products

(2015 – 2016)

94 Total Publications (67 conference/workshop, 27 journal)

Prominent Conferences...

- * Control: American Controls Conference (ACC), IEEE Conference on Decision Control (CDC)
- * Security: ACM Workshop on Moving Target Defense, ACM Conference on Computer and Communications Security (CCS), Network and Distributed System Security (NDSS) Symposium, USENIX Security Symposium
- * CPS: ACM International Conference on Embedded Systems for Energy-Efficient Building Environments, ICCPS
- * Other: Allerton, NetEcon, USA/Europe Air Traffic Management Seminar, ICML

Prominent Journals...

- * Automatica
- * IEEE Transactions on Automatic Control
- * IEEE Transactions on Control of Networked Systems
- * IEEE Transactions on Control Systems Technology
- * IEEE Transactions on Dependable and Secure Computing
- * IEEE Transactions on Human-Machine Systems
- * IEEE Transactions on Intelligent Transportation Systems
- * IEEE Transactions on Network Control Systems
- * IEEE Transactions on Power Systems
- * International Journal of Electrical Power and Energy Systems
- * Mathematics of Operations Research
- * SIAM Journal on Control and Optimization
- * Water Resource Research