

# Modeling Forum

## Results of the 2001 Mathematical Contest in Modeling

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### Introduction

A total of 496 teams of undergraduates, from 238 institutions in 11 countries, spent the second weekend in February working on applied mathematics problems in the 17th Mathematical Contest in Modeling (MCM) and in the 3rd Interdisciplinary Contest in Modeling (ICM). This issue of *The UMAP Journal* reports on the MCM contest; results and Outstanding papers from the ICM contest will appear in the next issue, Vol. 22, No. 4.

The 2001 MCM began at 12:01 A.M. on Friday, Feb. 9 and officially ended at 11:59 P.M. on Monday, Feb. 12. During that time, teams of up to three undergraduates were to research and submit an optimal solution for one of two open-ended modeling problems. The 2001 MCM marked the inaugural year for the new online contest, and it was a great success. Students were able to register, obtain contest materials, download the problems at the appropriate time, and enter data through COMAP'S MCM website.

Each team had to choose one of the two contest problems. After a weekend of hard work, solution papers were sent to COMAP on Monday. Nine of the top papers appear in this issue of *The UMAP Journal*.

Results and winning papers from the first sixteen contests were published in special issues of *Mathematical Modeling* (1985–1987) and *The UMAP Journal* (1985–2000). The 1994 volume of *Tools for Teaching*, commemorating the tenth anniversary of the contest, contains all of the 20 problems used in the first ten years of the contest and a winning paper for each. Limited quantities of that

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volume and of the special MCM issues of the *Journal* for the last few years are available from COMAP.

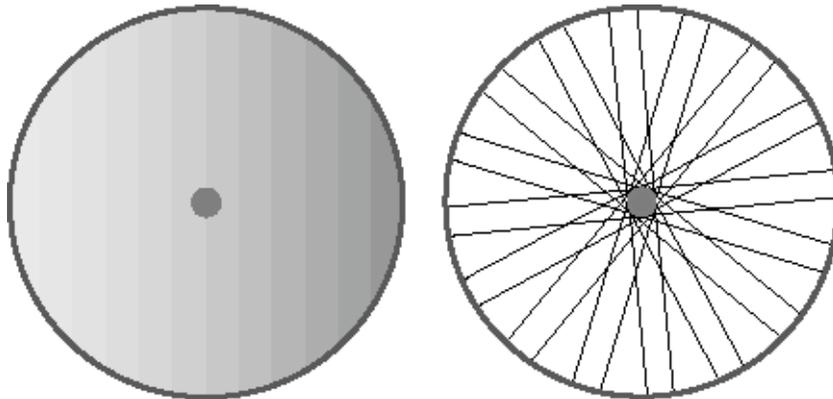
This year's Problem A was about bicycle wheels and what edge they may give to a race. Before any contest, professional cyclists make educated guesses about which one of two basic types of wheels to choose for any given competition. The team's Sports Director has asked them to come up with a better system to help determine which kind of wheel—wire spoke or solid disk—should be used for any given race course.

Problem B addressed the evacuation of Charleston, South Carolina during 1999's Hurricane Floyd. Maps, population data, and other specific details were given to the teams. They were tasked with constructing a model to investigate potential strategies. In addition, they were asked to submit a news article that would be used to explain their plan to the public.

## Problem A: The Bicycle Wheel Problem

### Introduction

Cyclists have different types of wheels they can use on their bicycles. The two basic types of wheels are those constructed using wire spokes and those constructed of a solid disk (see **Figure 1**). The spoked wheels are lighter but the solid wheels are more aerodynamic. A solid wheel is never used on the front for a road race but can be used on the rear of the bike.



**Figure 1.** Solid wheel (left) and spoked wheel (right).

Professional cyclists look at a racecourse and make an educated guess as to what kind of wheels should be used. The decision is based on the number and steepness of the hills, the weather, wind speed, the competition, and other considerations.

The *directeur sportif* of your favorite team would like to have a better system in place and has asked your team for information to help determine what kind of wheel should be used for a given course.

The *directeur sportif* needs specific information to help make a decision and has asked your team to accomplish the tasks listed below. For each of the tasks, assume that the same spoked wheel will always be used on the front but that there is a choice of wheels for the rear.

## Task 1

Provide a table giving the wind speed at which the power required for a solid rear wheel is less than for a spoked rear wheel. The table should include the wind speeds for different road grades starting from 0% to 10% in 1% increments. (Road grade is defined to be the ratio of the total rise of a hill divided by the length of the road.<sup>1</sup>) A rider starts at the bottom of the hill at a speed of 45 kph and the deceleration of the rider is proportional to the road grade. A rider will lose about 8 kph for a 5% grade over 100 m.

## Task 2

Provide an example of how the table could be used for a specific time trial course.

## Task 3

Determine if the table is an adequate means for deciding on the wheel configuration and offer other suggestions as to how to make this decision.

# Problem B: The Hurricane Evacuation Problem

Evacuating the coast of South Carolina ahead of the predicted landfall of Hurricane Floyd in 1999 led to a monumental traffic jam. Traffic slowed to a standstill on Interstate I-26, which is the principal route going inland from Charleston to the relatively safe haven of Columbia in the center of the state. What is normally an easy two-hour drive took up to 18 hours to complete. Many cars simply ran out of gas along the way. Fortunately, Floyd turned north and spared the state this time, but the public outcry is forcing state officials to find ways to avoid a repeat of this traffic nightmare.

The principal proposal put forth to deal with this problem is the reversal of traffic on I-26, so that both sides, including the coastal-bound lanes, have traffic headed inland from Charleston to Columbia. Plans to carry this out have been prepared (and posted on the Web) by the South Carolina Emergency

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<sup>1</sup>If the hill is viewed as a triangle, the grade is the sine of the angle at the bottom of the hill.

Preparedness Division. Traffic reversal on principal roads leading inland from Myrtle Beach and Hilton Head is also planned.

A simplified map of South Carolina is shown in **Figure 2**. Charleston has approximately 500,000 people, Myrtle Beach has about 200,000 people, and another 250,000 people are spread out along the rest of the coastal strip. (More accurate data, if sought, are widely available.)



**Figure 2.** Highways in South Carolina.

The interstates have two lanes of traffic in each direction except in the metropolitan areas, where they have three. Columbia, another metro area of around 500,000 people, does not have sufficient hotel space to accommodate the evacuees (including some coming from farther north by other routes); so some traffic continues outbound on I-26 towards Spartanburg, on I-77 north to Charlotte, and on I-20 east to Atlanta. In 1999, traffic leaving Columbia going northwest was moving only very slowly.

Construct a model for the problem to investigate what strategies may reduce the congestion observed in 1999. Here are the questions that need to be addressed:

1. Under what conditions does the plan for turning the two coastal-bound lanes of I-26 into two lanes of Columbia-bound traffic, essentially turning the entire I-26 into one-way traffic, significantly improve evacuation traffic flow?
2. In 1999, the simultaneous evacuation of the state's entire coastal region was ordered. Would the evacuation traffic flow improve under an alternative strategy that staggers the evacuation, perhaps county by county over some time period consistent with the pattern of how hurricanes affect the coast?
3. Several smaller highways besides I-26 extend inland from the coast. Under what conditions would it improve evacuation flow to turn around traffic on these?
4. What effect would it have on evacuation flow to establish additional temporary shelters in Columbia, to reduce the traffic leaving Columbia?
5. In 1999, many families leaving the coast brought along their boats, campers, and motor homes. Many drove all of their cars. Under what conditions should there be restrictions on vehicle types or numbers of vehicles brought in order to guarantee timely evacuation?
6. It has been suggested that in 1999 some of the coastal residents of Georgia and Florida, who were fleeing the earlier predicted landfalls of Hurricane Floyd to the south, came up I-95 and compounded the traffic problems. How big an impact can they have on the evacuation traffic flow?

Clearly identify what measures of performance are used to compare strategies.

Required: Prepare a short newspaper article, not to exceed two pages, explaining the results and conclusions of your study to the public.

## The Results

The solution papers were coded at COMAP headquarters so that names and affiliations of the authors would be unknown to the judges. Each paper was then read preliminarily by two "triage" judges at Southern Connecticut State University (Problem A) or at the National Security Agency (Problem B). At the triage stage, the summary and overall organization are the basis for judging a paper. If the judges' scores diverged for a paper, the judges conferred; if they still did not agree on a score, a third judge evaluated the paper.

Final judging took place at Harvey Mudd College, Claremont, California. The judges classified the papers as follows:

The nine papers that the judges designated as Outstanding appear in this special issue of *The UMAP Journal*, together with commentaries. We list those teams and the Meritorious teams (and advisors) below; the list of all participating schools, advisors, and results is in the **Appendix**.

|                      | Outstanding | Meritorious | Honorable<br>Mention | Successful<br>Participation | Total      |
|----------------------|-------------|-------------|----------------------|-----------------------------|------------|
| Bicycle Wheel        | 3           | 27          | 58                   | 127                         | 215        |
| Hurricane Evacuation | <u>6</u>    | <u>43</u>   | <u>65</u>            | <u>167</u>                  | <u>281</u> |
|                      | 9           | 70          | 123                  | 294                         | 496        |

## Outstanding Teams

### Institution and Advisor

### Team Members

#### Bicycle Wheel Papers

“Spokes or Discs?”

Stellenbosch University  
Matieland, South Africa  
Jan H. van Vuuren

W.D.V. De Wet  
D.F. Maian  
C. Mumbeck

“Selection of a Bicycle Wheel Type”

United States Military Academy  
West Point, NY  
Donovan D. Phillips

Nicholas J. Howard  
Zachariah R. Miller  
Matthew R. Adams

“A Systematic Technique for Optimal  
Bicycle Wheel Selection”

University College Cork  
Cork, Ireland  
James Jo Grannell

Michael Flynn  
Eamonn Long  
William Whelan-Curtin

#### Hurricane Evacuation Papers

“Project H.E.R.O.:

Hurricane Evacuation Route Optimization”

Bethel College  
St. Paul, MN  
William M. Kinney

Nathan M. Gossett  
Barbara A. Hess  
Michael S. Page

“Traffic Flow Models and  
the Evacuation Problem”

Duke University  
Durham, NC  
David P. Kraines

Samuel W. Malone  
Carl A. Miller  
Daniel B. Neill

**"The Crowd Before the Storm"**

The Governor's School  
Richmond, VA  
John A. Barnes

Jonathan D. Charlesworth  
Finale P. Doshi  
Joseph E. Gonzalez

**"Jammin' with Floyd: A Traffic Flow Analysis  
of South Carolina Hurricane Evacuation"**

Harvey Mudd College  
Claremont, CA  
Ran Libeskind-Hadas

Christopher Hanusa  
Ari Nie  
Matthew Schnaider

**"Blowin' in the Wind"**

Lawrence Technological University  
Southfield, MI  
Ruth G. Favro

Mark Wagner  
Kenneth Kopp  
William E. Kolasa

**"Please Move Quickly and Quietly to the  
Nearest Freeway"**

Wake Forest University  
Winston-Salem, NC  
Miaohua Jiang

Corey R. Houmand  
Andrew D. Pruett  
Adam S. Dickey

**Meritorious Teams****Bicycle Wheel Papers** (27 teams)

Beijing University of Chemical Technology, Beijing, P.R. China (Jiang Guangfeng)  
Beijing University of Chemical Technology, Beijing, P.R. China (Wenyan Yuan)  
Brandon University, Brandon, Canada (Doug A. Pickering)  
California Polytechnic State University, San Luis Obispo, CA (Thomas O'Neil)  
Harbin Engineering University, Harbin, P.R. China (Gao Zhenbin)  
Harbin Institute of Technology, Harbin, P.R. China (Shang Shouting)  
Harvey Mudd College, Claremont, CA (Michael E. Moody)  
James Madison University, Harrisonburg, VA (James S. Sochacki)  
Jilin University of Technology, Changchun, P.R. China (Fang Peichen)  
John Carroll University, University Heights, OH (Angela, S. Spalsbury)  
Lafayette College, Easton, PA (Thomas Hill)  
Lake Superior State University, Sault Sainte Marie, MI (J. Jaroma and D. Baumann)  
Lewis and Clark College, Portland, OR (Robert W. Owens)  
Southeast University, Nanjing, P.R. China (Chen En-shui)  
Tianjin University, Tianjin, P.R. China (Dong Wenjun)  
Trinity University, San Antonio, TX (Fred M. Loxsom)  
United States Air Force Academy, USAF Academy, CO (Jim West)  
University College Dublin, Dublin, Ireland (Peter Duffy)  
University of Western Ontario, London, Canada (Peter H. Poole)  
Washington University, St. Louis, MO (Hiro Mukai)

Westminster College, New Wilmington, PA (Barbara T. Faires) (two teams)  
Wright State University, Dayton, OH (Thomas P. Svobodny)  
Youngstown State University, Youngstown, OH (Thomas Smotzer)  
Zhejiang University, Hangzhou, P.R. China (He Yong)  
Zhejiang University, Hangzhou, P.R. China (Yang Qifan)  
Zhongshan University, Guangzhou, P.R. China (Chen Zepeng)

**Hurricane Evacuation Papers** (43 teams)

Beijing University of Posts & Telecommunications, Beijing, P.R. China (He Zuguo)  
California Polytechnic State University, San Luis Obispo, CA (Thomas O'Neil)  
Central South University, Changsha, P.R. China (Zheng Zhou-shun)  
Clarion University, Clarion, PA (Jon A. Beal)  
Dong Hua University, Shanghai, China (Ding Yongsheng)  
East China University of Science & Technology, Shanghai, P.R. China (Liu Zhaohui)  
Gettysburg College, Gettysburg, PA (Sharon L. Stephenson)  
Hillsdale College, Hillsdale, MI (Robert J. Hesse)  
James Madison University, Harrisonburg, VA (Caroline Smith)  
Jiading No. 1 High School, Jiading, P.R. China (Wang Yu)  
MIT, Cambridge, MA (Dan Rothman)  
N.C. School of Science and Mathematics, Durham, NC (Dot Doyle)  
National University of Defence Technology, Changsha, P.R. China (Wu Mengda)  
National University of Singapore, Singapore, Singapore  
(Lim Leong Chye Andrew)  
North Carolina State University, Raleigh, NC (Jeffrey S. Scroggs)  
Northeastern University, Shenyang, P.R. China (Xiao Wendong)  
Pacific Lutheran University, Tacoma, WA (Zhu Mei)  
Päivölä College, Tarttila, Finland (Merikki Lappi)  
Rose-Hulman Institute of Technology, Terre Haute, IN (David J. Rader)  
Rowan University, Glassboro, NJ (Paul J. Laumakis)  
Shanghai Foreign Language School, Shanghai, P.R. China (Pan Li Qun)  
South China University of Technology, Guangzhou, P.R. China (Lin Jianliang)  
Southern Oregon University, Ashland, OR (Lisa M. Ciasullo)  
U.S. Military Academy, West Point, NY (David Sanders)  
U.S. Military Academy, West Point, NY (Edward Connors)  
University of Alaska Fairbanks, Fairbanks, AK (Chris Hartman)  
University of Colorado–Boulder, Boulder, CO (Bengt Fornberg)  
University of Massachusetts Lowell, Lowell, MA (James Graham-Eagle)  
University of North Texas, Denton, TX (John A. Quintanilla)  
University of Richmond, Richmond, VA (Kathy W. Hoke)  
University of Science and Technology of China, Hefei, P.R. China (Gu Jiajun)  
University of South Carolina Aiken, Aiken, SC (Laurene V. Fausett)  
University of South Carolina, Columbia, SC (Ralph E. Howard)  
University of Southern Queensland, Toowoomba, Queensland, Australia (Tony J. Roberts)  
University of Washington, Seattle, WA (James Allen Morrow)  
Wake Forest University, Winston-Salem, NC (Miaohua Jiang)

Washington University, St. Louis, MO (Hiro Mukai)  
 Western Washington University, Bellingham, WA (Saim Ural)  
 Worcester Polytechnic Institute, Worcester, MA (Bogdan Vernescu)  
 Wuhan University, Wuhan, P.R. China (Huang Chongchao)  
 York University, Toronto, Ontario, Canada (Juris Steprans)  
 Zhejiang University, Hangzhou, P.R. China (He Yong)  
 Zhejiang University, Hangzhou, P.R. China (Yang Qifan)

## Awards and Contributions

Each participating MCM advisor and team member received a certificate signed by the Contest Director and the appropriate Head Judge.

INFORMS, the Institute for Operations Research and the Management Sciences, gave a cash prize and a three-year membership to each member of the teams from Stellenbosch University (Bicycle Wheel Problem) and Lawrence Technological University (Hurricane Evacuation Problem). Also, INFORMS gave free one-year memberships to all members of Meritorious and Honorable Mention teams. The Lawrence Tech team presented its results at the annual INFORMS meeting in Washington DC in April.

The Society for Industrial and Applied Mathematics (SIAM) designated one Outstanding team from each problem as a SIAM Winner. The teams were from U.S. Military Academy (Bicycle Wheel Problem) and Wake Forest University (Hurricane Evacuation Problem). Each of the team members was awarded a \$300 cash prize and the teams received partial expenses to present their results at a special Minisymposium of the SIAM Annual Meeting in San Diego CA in July. Their schools were given a framed, hand-lettered certificate in gold leaf.

The Mathematical Association of America (MAA) designated one Outstanding team from each problem as an MAA Winner. The teams were from University College Cork (Bicycle Wheel Problem) and Wake Forest University (Hurricane Evacuation Problem). With partial travel support from the MAA, both teams presented their solutions at a special session of the MAA Mathfest in Madison WI in August. Each team member was presented a certificate by MAA President Ann Watkins.

## Judging

### *Director*

Frank R. Giordano, COMAP, Lexington, MA

### *Associate Directors*

Robert L. Borrelli, Mathematics Dept., Harvey Mudd College,  
 Claremont, CA

Patrick Driscoll, Dept. of Mathematical Sciences, U.S. Military Academy,  
West Point, NY  
William Fox, Mathematics Dept., Francis Marion University, Florence, SC  
Michael Moody, Mathematics Dept., Harvey Mudd College,  
Claremont, CA

### **Bicycle Wheel Problem**

#### *Head Judge*

Marvin S. Keener, Executive Vice-President, Oklahoma State University,  
Stillwater, OK

#### *Associate Judges*

Ronald Barnes, University of Houston Downtown, Houston TX (MAA)  
Kelly Black, Mathematics Dept., University of New Hampshire,  
Durham, NH (SIAM)  
David Elliott, Institute for System Research, University of Maryland,  
College Park, MD (SIAM)  
Ben Fusaro, Mathematics Dept., Florida State University,  
Tallahassee, FL  
Mario Juncosa, RAND Corporation, Santa Monica, CA  
John Kobza, Texas Tech University, Lubbock, TX (INFORMS)  
Dan Solow, Mathematics Dept., Case Western Reserve University,  
Cleveland, OH (INFORMS)

### **Hurricane Evacuation Problem**

#### *Head Judge*

Maynard Thompson, Mathematics Dept., University of Indiana,  
Bloomington, IN

#### *Associate Judges*

Paul Boisen, National Security Agency, Ft. Meade, MD (Triage)  
James Case, Baltimore, Maryland  
Courtney Coleman, Mathematics Dept., Harvey Mudd College,  
Claremont, CA  
Lisette De Pillis, Harvey Mudd College, Claremont, CA  
William Fox, Dept. of Mathematical Sciences, U.S. Military Academy,  
West Point, NY  
Jerry Griggs, University of South Carolina, Columbia, SC  
Jeff Hartzler, Mathematics Dept., Pennsylvania State University Middletown,  
Middletown, PA (MAA)  
Deborah Levinson, Compaq Computer Corp., Colorado Springs, CO  
Veena Mendiratta, Lucent Technologies, Naperville, IL  
Don Miller, Dept. of Mathematics, St. Mary's College, Notre Dame, IN (SIAM)  
Mark R. Parker, Mathematics Dept., Carroll College, Helena, MT (SIAM)

John L. Scharf, Carroll College, Helena, MT  
Lee Seitelman, Glastonbury, CT (SIAM)  
Kathleen M. Shannon, Salisbury State University, Salisbury, MD  
Michael Tortorella, Lucent Technologies, Holmdel, NJ  
Marie Vanisko, Carroll College, Helena, MT  
Cynthia J. Wyels, Dept. of Mathematics, Physics, and Computer Science,  
California Lutheran University, Thousand Oaks, CA

### **Triage Sessions:**

#### **Bicycle Wheel Problem**

##### *Head Triage Judge*

Theresa M. Sandifer, Southern Connecticut State University, New Haven, CT

##### *Associate Judges*

Therese L. Bennett, Southern Connecticut State University, New Haven, CT

Ross B. Gingrich, Southern Connecticut State University, New Haven, CT

Cynthia B. Gubitose, Western Connecticut State University, Danbury, CT

Ron Kutz, Western Connecticut State University, Danbury, CT

C. Edward Sandifer, Western Connecticut State University, Danbury, CT

#### **Hurricane Evacuation Problem**

##### *Head Triage Judge*

Paul Boisen, National Security Agency, Ft. Meade, MD

##### *Associate Judges*

James Case, Baltimore, Maryland

Peter Anspach, Jennifer McGreevy, Erin Schram, Larry Wargo, and 7 others  
from the National Security Agency

## **Sources of the Problems**

The Bicycle Wheel Problem was contributed by Kelly Black, Mathematics Dept., University of New Hampshire, Durham, NH. The Hurricane Evacuation Problem was contributed by Jerry Griggs, Mathematics Dept., University of South Carolina, Columbia, SC.

## **Acknowledgments**

The MCM was funded this year by the National Security Agency, whose support we deeply appreciate. We thank Dr. Gene Berg of NSA for his coordinating efforts. The MCM is also indebted to INFORMS, SIAM, and the MAA, which provided judges and prizes.

I thank the MCM judges and MCM Board members for their valuable and unflagging efforts. Harvey Mudd College, its Mathematics Dept. staff, and Prof. Borrelli were gracious hosts to the judges.

## Cautions

*To the reader of research journals:*

Usually a published paper has been presented to an audience, shown to colleagues, rewritten, checked by referees, revised, and edited by a journal editor. Each of the student papers here is the result of undergraduates working on a problem over a weekend; allowing substantial revision by the authors could give a false impression of accomplishment. So these papers are essentially *au naturel*. Light editing has taken place: minor errors have been corrected, wording has been altered for clarity or economy, and style has been adjusted to that of *The UMAP Journal*. Please peruse these student efforts in that context.

*To the potential MCM Advisor:*

It might be overpowering to encounter such output from a weekend of work by a small team of undergraduates, but these solution papers are highly atypical. A team that prepares and participates will have an enriching learning experience, independent of what any other team does.

## Appendix: Successful Participants

## KEY:

P = Successful Participation

A = Bicycle Wheel Control Problem

H = Honorable Mention

B = Hurricane Evacuation Problem

M = Meritorious

O = Outstanding (published in this special issue)

| INSTITUTION                       | CITY             | ADVISOR                | A | B   |
|-----------------------------------|------------------|------------------------|---|-----|
| <b>ALABAMA</b>                    |                  |                        |   |     |
| Huntingdon College                | Montgomery       | Robert L. Robertson    |   | P,P |
| <b>ALASKA</b>                     |                  |                        |   |     |
| University of Alaska Fairbanks    | Fairbanks        | Chris Hartman          |   | M   |
| <b>ARIZONA</b>                    |                  |                        |   |     |
| McClintock High School            | Tempe            | James S. Gibson        | P |     |
| <b>CALIFORNIA</b>                 |                  |                        |   |     |
| California Lutheran University    | Thousand Oaks    | Sandy Lofstock         |   | H,P |
| California Poly. State University | San Luis Obispo  | Matthew J. Moelter     | P |     |
|                                   |                  | Thomas O'Neil          | M | M   |
| California State University       | Bakersfield      | Maureen E. Rush        |   | P   |
| Christian Heritage College        | El Cajon         | Tibor F. Szarvas       | P |     |
| Harvey Mudd College               | Claremont        | Ran Libeskind-Hadas    |   | O,H |
|                                   |                  | Michael E. Moody       | M | H   |
| Occidental College                | Los Angeles      | Ramin Naimi            |   | P   |
| University of California          | Berkeley         | Brian W. Curtin        |   | P,P |
| <b>COLORADO</b>                   |                  |                        |   |     |
| Colorado College                  | Colorado Springs | Peter L. Staab         | H | H   |
| Mesa State College                | Grand Junction   | Edward K. Bonan-Hamada |   | H,P |
| Regis University                  | Denver           | Linda L. Duchrow       |   | P   |
| United States Air Force Academy   | USAF Academy     | James S. Rolf          | P |     |
|                                   |                  | Jim West               |   | M   |
| University of Colorado            | Colorado Springs | Gregory J. Morrow      | P |     |
|                                   | Boulder          | Bengt Fornberg         | H | M   |
| University of Southern Colorado   | Pueblo           | James N. Louisell      | H |     |
| <b>CONNECTICUT</b>                |                  |                        |   |     |
| Sacred Heart University           | Fairfield        | Peter Loth             |   | P   |
| Southern Conn. State University   | New Haven        | Therese L. Bennett     | H |     |
| <b>DISTRICT OF COLUMBIA</b>       |                  |                        |   |     |
| Georgetown University             | Washington       | Andrew J. Vogt         | P | P   |

| INSTITUTION                      | CITY          | ADVISOR             | A   | B   |
|----------------------------------|---------------|---------------------|-----|-----|
| FLORIDA                          |               |                     |     |     |
| Embry-Riddle Aero. University    | Daytona Beach | Greg Scott Spradlin | P,P |     |
| Florida A&M University           | Tallahassee   | Bruno Guerrieri     | P   | P   |
| Stetson University               | DeLand        | Lisa O. Coulter     |     | P   |
| University of North Florida      | Jacksonville  | Peter A. Braza      |     | P   |
| GEORGIA                          |               |                     |     |     |
| Agnes Scott College              | Decatur       | Robert A. Leslie    |     | P,P |
| Georgia Southern University      | Statesboro    | Goran Lesaja        |     | H,P |
| State University of West Georgia | Carrollton    | Scott Gordon        | P   |     |
| IDAHO                            |               |                     |     |     |
| Albertson College of Idaho       | Caldwell      | Mike Hitchman       | P   |     |
| Boise State University           | Boise         | Jodi L. Mead        |     | P   |
| ILLINOIS                         |               |                     |     |     |
| Greenville College               | Greenville    | Galen R. Peters     |     | H,P |
| Illinois Wesleyan University     | Bloomington   | Zahia Drici         | P,P |     |
| Northern Illinois University     | DeKalb        | Emil Cornea         | P   |     |
| Wheaton College                  | Wheaton       | Paul Isihara        |     | H,P |
| INDIANA                          |               |                     |     |     |
| Goshen College                   | Goshen        | David Housman       |     | H,H |
| Indiana University               | Bloomington   | Michael S. Jolly    | H   |     |
| Rose-Hulman Inst. of Technology  | Terre Haute   | David J. Rader      |     | M,P |
|                                  |               | Frank Young         |     | H   |
| Saint Mary's College             | Notre Dame    | Peter D. Smith      |     | H,P |
| IOWA                             |               |                     |     |     |
| Grand View College               | Des Moines    | Sergio Loch         | P   | P   |
| Grinnell College                 | Grinnell      | Marc A. Chamberland | H   | H   |
|                                  |               | Mark Montgomery     | P,P |     |
| Luther College                   | Decorah       | Reginald D. Laursen |     | H,P |
| Mt. Mercy College                | Cedar Rapids  | K.R. Knopp          |     | H   |
| Simpson College                  | Indianola     | Murphy Waggoner     | P   | P   |
|                                  |               | Werner S. Kolln     | H   |     |
| Wartburg College                 | Waverly       | Mariah Birgen       |     | P,P |
| KANSAS                           |               |                     |     |     |
| Emporia State University         | Emporia       | Ton Boerkoel        | P   |     |
| Kansas State University          | Manhattan     | Korten N. Auckly    |     | P   |
| KENTUCKY                         |               |                     |     |     |
| Asbury College                   | Wilmore       | Kenneth P. Rietz    | H   | H   |
| Spalding University              | Louisville    | Scott W. Bagley     |     | P   |

| INSTITUTION                    | CITY               | ADVISOR                          | A   | B   |
|--------------------------------|--------------------|----------------------------------|-----|-----|
| LOUISIANA                      |                    |                                  |     |     |
| Northwestern State University  | Natchitoches       | Richard C. DeVault               | P   |     |
| MAINE                          |                    |                                  |     |     |
| Colby College                  | Waterville         | Jan Holly                        |     | H   |
| MARYLAND                       |                    |                                  |     |     |
| Goucher College                | Baltimore          | Robert E. Lewand                 | H,P |     |
| Johns Hopkins University       | Baltimore          | Daniel Q. Naiman                 |     | P   |
| Mount Saint Mary's College     | Emmitsburg         | William E. O'Toole               |     | P   |
|                                |                    | Fred Portier                     | P   |     |
| Salisbury State University     | Salisbury          | Steven M. Hetzler                | H   |     |
|                                |                    | Michael J. Bardzell              |     | P   |
| MASSACHUSETTS                  |                    |                                  |     |     |
| MIT                            | Cambridge          | Dan Rothman                      |     | M,H |
| Salem State College            | Salem              | Kenny Ching                      |     | P   |
| Smith College                  | Northampton        | Ruth Haas                        |     | P   |
| University of Massachusetts    | Lowell             | James Graham-Eagle               | P   | M   |
| Williams College               | Williamstown       | Stewart D. Johnson               | P   |     |
|                                |                    | Frank Morgan                     | P   |     |
|                                |                    | Cesar E. Silva                   |     | P   |
| Worcester Poly. Inst.          | Worcester          | Bogdan Vernescu                  |     | M   |
| MICHIGAN                       |                    |                                  |     |     |
| Calvin College                 | Grand Rapids       | Randall J. Pruim                 |     | P   |
| Eastern Michigan University    | Ypsilanti          | Christopher E. Hee               | P   | P   |
| Hillsdale College              | Hillsdale          | Robert J. Hesse                  |     | M   |
| Lake Superior State University | Sault Sainte Marie | John Jaroma and<br>David Baumann | M   |     |
| Lawrence Tech. University      | Southfield         | Ruth G. Favro                    |     | O   |
|                                |                    | Scott Schneider                  | H   |     |
|                                |                    | Howard Whitston                  | P   |     |
| Siena Heights University       | Adrian             | Toni Carroll                     |     | P,P |
|                                |                    | Rick V. Trujillo                 | P   |     |
| University of Michigan         | Dearborn           | David James                      |     | P   |
| MINNESOTA                      |                    |                                  |     |     |
| Bemidji State University       | Bemidji            | Colleen G. Livingston            |     | P,P |
| Bethel College                 | St. Paul           | William M. Kinney                |     | O   |
| Macalester College             | St. Paul           | A. Wayne Roberts                 | P   | P   |
| St. Olaf College               | Northfield         | Philip J. Gloor                  |     | P   |
| University of Minnesota        | Morris             | Peh H. Ng                        | P   |     |

| INSTITUTION                      | CITY            | ADVISOR               | A  | B  |
|----------------------------------|-----------------|-----------------------|----|----|
| <b>MISSOURI</b>                  |                 |                       |    |    |
| Crowder College                  | Neosho          | Cheryl L. Ingram      | P  |    |
| Missouri Southern State College  | Joplin          | Patrick Cassens       | P  | P  |
| Northwest Missouri State Univ.   | Maryville       | Russell N. Euler      | P  | P  |
| Southeast Missouri State Univ.   | Cape Girardeau  | Robert W. Sheets      | H  |    |
| Truman State University          | Kirksville      | Steve Jay Smith       | P  |    |
| Washington University            | St. Louis       | Hiro Mukai            | M  | M  |
| Wentworth Mil. Acad. & Jr. Coll. | Lexington       | Jacqueline O. Maxwell | P  | P  |
| <b>MONTANTA</b>                  |                 |                       |    |    |
| Carroll College                  | Helena          | Philip B. Rose        | P  |    |
|                                  |                 | Holly S. Zullo        | P  | P  |
| St. Andrew University            | Helena          | Mark J. Keeffe        | P  |    |
| <b>NEBRASKA</b>                  |                 |                       |    |    |
| Hastings College                 | Hastings        | David B. Cooke        | P  |    |
| University of Nebraska           | Lincoln         | Glenn W. Ledder       |    | H  |
| <b>NEVADA</b>                    |                 |                       |    |    |
| University of Nevada             | Reno            | Mark M. Meerschaert   | P  |    |
| <b>NEW JERSEY</b>                |                 |                       |    |    |
| Montclair State University       | Upper Montclair | Michael A. Jones      | P  |    |
| Rowan University                 | Glassboro       | Paul J. Laumakis      |    | M  |
| <b>NEW YORK</b>                  |                 |                       |    |    |
| Hunter College, City Univ. of NY | New York        | Ada Peluso            | H  |    |
| Ithaca College                   | Ithaca          | John C. Maceli        |    | P  |
| Manhattan College                | Riverdale       | Kathryn C. Weld       | P  |    |
| Marist College                   | Poughkeepsie    | Tracey B. McGrail     |    | P  |
| State University of NY           | Cortland        | George F. Feissner    |    | P  |
|                                  |                 | R. Bruce Mattingly    | P  |    |
| U.S. Military Academy            | West Point      | Edward Connors        |    | M  |
|                                  |                 | Gregory Parnell       |    | H  |
|                                  |                 | Donovan D. Phillips   | O  |    |
|                                  |                 | David Sanders         |    | M  |
| Westchester Comm. College        | Valhalla        | Sheela L. Whelan      | PP |    |
| <b>NORTH CAROLINA</b>            |                 |                       |    |    |
| Appalachian State University     | Boone           | Holly P. Hirst        |    | H  |
|                                  |                 | Eric S. Marland       |    | P  |
| Brevard College                  | Brevard         | Clarke Wellborn       |    | PP |
| Davidson College                 | Davidson        | Laurie J. Heyer       |    | H  |
| Duke University                  | Durham          | David P. Kraines      |    | O  |
| N.C. School of Sci. & Math.      | Durham          | Dot Doyle             |    | M  |

| INSTITUTION                  | CITY               | ADVISOR                | A   | B   |
|------------------------------|--------------------|------------------------|-----|-----|
| North Carolina State Univ.   | Raleigh            | Jeffrey S. Scroggs     |     | M,H |
| University of North Carolina | Wilmington         | Russell L. Herman      | P   |     |
| Wake Forest University       | Winston-Salem      | Miaohua Jiang          |     | O,M |
| Western Carolina University  | Cullowhee          | Jeffrey Allen Graham   |     | P   |
| OHIO                         |                    |                        |     |     |
| The College of Wooster       | Wooster            | Pamela Pierce          | P   |     |
| Hiram College                | Hiram              | Brad S. Gubser         | H   |     |
| John Carroll University      | University Heights | Angela S. Spalsbury    | M   | P   |
| Miami University             | Oxford             | Doug E. Ward           | P   |     |
| Oberlin College              | Oberlin            | Elizabeth L. Wilmer    | P   |     |
| Ohio University              | Athens             | David N. Keck          | P   |     |
| Wright State University      | Dayton             | Thomas P. Svobodny     | M,P |     |
| Youngstown State University  | Youngstown         | Stephen Hanzely        | P   |     |
|                              |                    | Robert Kramer          |     | P   |
|                              |                    | Thomas Smotzer         | M   | H   |
| OKLAHOMA                     |                    |                        |     |     |
| Oklahoma State University    | Stillwater         | John E. Wolfe          |     | P,P |
| Southern Nazarene Univ.      | Bethany            | Virgil Lee Turner      | H   |     |
| Univ. of Central Oklahoma    | Edmond             | Charles Cooper         |     | P   |
|                              |                    | Dan Endres             | P   |     |
| OREGON                       |                    |                        |     |     |
| Eastern Oregon University    | La Grande          | Robert Huotari         |     | H   |
|                              |                    | Anthony Tovar          | H,P |     |
|                              |                    | Jennifer Woodworth     |     | P   |
| Lewis & Clark College        | Portland           | Robert W. Owens        | M   |     |
| Portland State University    | Portland           | Gerardo A. Lafferriere |     | H,P |
| Southern Oregon University   | Ashland            | Lisa M. Ciasullo       |     | M   |
| University of Portland       | Portland           | Thomas W. Judson       | P   |     |
| PENNSYLVANIA                 |                    |                        |     |     |
| Bloomsburg University        | Bloomsburg         | Kevin K. Ferland       | P   | H   |
| Clarion University           | Clarion            | Jon A. Beal            |     | M   |
|                              |                    | John W. Heard          | P   |     |
| Gettysburg College           | Gettysburg         | James P. Fink          | H   | H   |
|                              |                    | Carl Leinbach          |     | H   |
|                              |                    | Sharon L. Stephenson   |     | M   |
| Lafayette College            | Easton             | Thomas Hill            | M   |     |
| Shippensburg University      | Shippensburg       | Cheryl Olsen           | P   |     |
| Villanova University         | Villanova          | Bruce Pollack-Johnson  | P   |     |
| Westminster College          | New Wilmington     | Barbara T. Faires      | M,M |     |

| INSTITUTION                        | CITY         | ADVISOR             | A   | B   |
|------------------------------------|--------------|---------------------|-----|-----|
| RHODE ISLAND                       |              |                     |     |     |
| Rhode Island College               | Providence   | David L. Abrahamson |     | P   |
| SOUTH CAROLINA                     |              |                     |     |     |
| Charleston Southern University     | Charleston   | Stan Perrine        |     | P,P |
| Coastal Carolina University        | Conway       | Ioana Mihaila       |     | P   |
| Francis Marion University          | Florence     | Thomas L. Fitzkee   |     | P   |
| Midlands Technical College         | Columbia     | SJohn R. Long       |     | P   |
| University of South Carolina       | Aiken        | Laurene V. Fausett  |     | M,P |
|                                    | Columbia     | Ralph E. Howard     |     | M   |
| SOUTH DAKOTA                       |              |                     |     |     |
| Mount Marty College                | Yankton      | Jim Miner           |     | P   |
| S.D. School of Mines & Tech.       | Rapid City   | Kyle L. Riley       | P   | P   |
| TENNESSEE                          |              |                     |     |     |
| Christian Brothers University      | Memphis      | Cathy W. Carter     |     | P   |
| Lipscomb University                | Nashville    | Mark A. Miller      | P   |     |
| TEXAS                              |              |                     |     |     |
| Abilene Christian University       | Abilene      | David Hendricks     |     | H   |
| Angelo State University            | San Angelo   | Trey Smith          | H   |     |
| Baylor University                  | Waco         | Frank H. Mathis     | H   |     |
| Southwestern University            | Georgetown   | Therese N. Shelton  | P   |     |
| Stephen F. Austin State University | Nacogdoches  | Colin L. Starr      |     | P   |
| Trinity University                 | San Antonio  | Allen G. Holder     | P   |     |
|                                    |              | Jeffrey K. Lawson   |     | P   |
|                                    |              | Fred M. Loxsom      | M   |     |
|                                    |              | Hector C. Mireles   |     | P   |
| University of Houston              | Houston      | Barbara Lee Keyfitz | P   |     |
| University of North Texas          | Denton       | John A. Quintanilla |     | M   |
| University of Texas                | Austin       | Lorenzo A. Sadun    |     | P   |
| UTAH                               |              |                     |     |     |
| Weber State University             | Ogden        | Richard R. Miller   | H   |     |
| VERMONT                            |              |                     |     |     |
| Johnson State College              | Johnson      | Glenn D. Sproul     | P   | P   |
| VIRGINIA                           |              |                     |     |     |
| Eastern Mennonite University       | Harrisonburg | John Horst          | P   | H   |
| The Governor's School              | Richmond     | John A. Barnes      | P   | O   |
|                                    |              | Crista Hamilton     | H,P |     |
| James Madison University           | Harrisonburg | Caroline Smith      |     | M   |
|                                    |              | James S. Sochacki   | M   |     |
| Randolph-Macon College             | Ashland      | Bruce F. Torrence   |     | P   |

| INSTITUTION                              | CITY           | ADVISOR               | A   | B   |
|--|----------------|-----------------------|-----|-----|
| Roanoke College                          | Salem          | Jeffrey L. Spielman   | H   |     |
| University of Richmond                   | Richmond       | Kathy W. Hoke         |     | M   |
| Univ. of Virginia's College at Wise      | Wise           | George W. Moss        | P   | P   |
| Virginia Western Comm. College           | Roanoke        | Steve T. Hammer       |     | H   |
|  |                | Ruth A. Sherman       |     | P   |
| WASHINGTON                               |                |                       |     |     |
| Pacific Lutheran University              | Tacoma         | Mei Zhu               | H   | M   |
| University of Puget Sound                | Tacoma         | DeWayne R. Derryberry | P   | P   |
|  |                | Carol M. Smith        |     | P   |
| University of Washington                 | Seattle        | Randall J. LeVeque    |     | H   |
|  |                | James Allen Morrow    |     | M   |
| Wenatchee Valley College                 | Omak           | Kit A. Arbuckle       | P   |     |
| Western Washington University            | Bellingham     | Saim Ural             |     | M   |
|  |                | Tjalling Ypma         | H,H |     |
| WEST VIRGINNIA                           |                |                       |     |     |
| West Virginia Wesleyan College           | Buckhannon     | Jeffery D. Sykes      |     | P   |
| WISCONSIN                                |                |                       |     |     |
| Beloit College                           | Beloit         | Paul J. Campbell      |     | P   |
| Ripon                                    | Ripon College  | David W. Scott        |     | P   |
| Univ. of Wisconsin–Stevens Point         | Stevens Point  | Nathan R. Wetzel      |     | P   |
| Univ. of Wisconsin–Stout                 | Menomonie      | Maria G. Fung         |     | H   |
| Wisconsin Lutheran College               | Milwaukee      | Marvin C. Papenfuss   |     | P   |
| AUSTRALIA                                |                |                       |     |     |
| University of New South Wales            | Sydney, NSW    | James Franklin        |     | H,H |
| University of Southern Queensland        | Toowoomba, QLD | Tony J. Roberts       |     | M   |
| CANADA                                   |                |                       |     |     |
| Brandon University                       | Brandon, MB    | Doug A. Pickering     | M   |     |
| Dalhousie University                     | Halifax, NS    | John C. Clements      |     | P   |
|  |                | Dorette A. Pronk      |     | P   |
| Memorial Univ. of Newfoundland           | St. John's, NF | Andy Foster           | P   |     |
| University of Saskatchewan               | Saskatoon, SK  | James A. Brooke       | H,P |     |
|  |                | Tom G. Steele         | H   |     |
| University of Toronto                    | Toronto, ON    | Nicholas A. Derzko    |     | P   |
| University of Western Ontario            | London, ON     | Peter H. Poole        | M,P |     |
| York University                          | Toronto, ON    | Juris Steprans        |     | M,H |
| CHINA                                    |                |                       |     |     |
| Anhui Mechanical and Electronics College | Wuhu           | Wang Chuanyu          |     | P   |
|  |                | Wang Geng             |     | P   |
|  |                | Yang Yimin            |     | P   |

| INSTITUTION                                | CITY      | ADVISOR         | A   | B   |
|--|-----------|-----------------|-----|-----|
| Anhui University                           | Hefei     | Cai Qian        |     | P   |
|  |           | Wang Da-peng    |     | H   |
|  |           | Zhang Quan-bing | P   |     |
| Beijing Institute of Technology            | Beijing   | Chen Yihong     | H   | P   |
|  |           | Cui Xiaodi      | P,P |     |
|  |           | Yao Cuizhen     | H   | P   |
| Beijing Union University                   | Beijing   | Jiang Xinhua    | P   |     |
|  |           | Ren Kailong     |     | P   |
|  |           | Wang Xinfeng    |     | P   |
|  |           | Zeng Qingli     | P   |     |
| Beijing University of Aero. & Astronautics | Beijing   | Peng Linping    | H,H |     |
|  |           | Wu Sanxing      |     | P,P |
| Beijing University of Chemical Technology  | Beijing   | Cheng Yan       | P   |     |
|  |           | Jiang Guangfeng | M   |     |
|  |           | Liu Daming      | P   |     |
|  |           | Wenyan Yuan     | M   |     |
| Beijing University of Posts & Telecomm.    | Beijing   | He Zuguo        |     | M,H |
|  |           | Luo Shoushan    | P,P |     |
| Central South University                   | Changsha  | Zhang Hong-yan  | P   |     |
|  |           | Zheng Zhou-shun |     | M   |
| China University of Mining & Technology    | Xuzhou    | Wu Zongxiang    | P   | P   |
|  |           | Zhu Kaiyong     | P   | P   |
| Chongqing University                       | Chongqing | Gong Qu         | P   | H   |
|  |           | Li Fu           |     | P   |
|  |           | Zhan Lezhou     | H   |     |
| Dalian University of Technology            | Dalian    | Ding Yongsheng  |     | M   |
|  |           | He Mingfeng     | H   | P   |
|  |           | Yu Hongquan     |     | H   |
| Dong Hua University                        | Shanghai  | Hu Liangjian    |     | H   |
|  |           | Lu Yunsheng     | P   |     |
| East China Normal University               | Shanghai  | Jiang Lumin     | P   |     |
|  |           | Zhen Dong Yuan  |     | P   |
| East China Univ. of Science and Technology | Shanghai  | Liu Zhaohui     |     | M   |
|  |           | Lu Yuanhong     | H   |     |
|  |           | Qin Yan         | H   |     |
|  |           | Shi Jinsong     |     | H   |
| Fudan University                           | Shanghai  | Cai Zhijie      | P,P |     |
|  |           | Gong XueQing    | P   | P   |
|  |           | Xu Qinfeng      |     | P   |
| Guangdong Commercial College               | Guangzhou | Xiang Zigui     | P   | P   |

| INSTITUTION                                | CITY      | ADVISOR        | A   | B   |
|--|-----------|----------------|-----|-----|
| Harbin Engineering University              | Harbin    | Gao Zhenbin    | M   |     |
|  |           | Luo Yuesheng   | H   |     |
|  |           | Shen Jihong    |     | P   |
|  |           | Zhang Xiaowei  |     | P   |
| Harbin Institute of Technology             | Harbin    | Shang Shouting | M   | P   |
|  |           | Shao Jiqun     | H   |     |
|  |           | Wang Xuefeng   |     | P   |
| Hefei University of Technology             | Hefei     | Du Xueqiao     | P   | H   |
|  |           | Huang Youdu    | P,P |     |
| Hu Ning (individual, one-member team)      | Suzhou    |                |     | P   |
| Information & Engineering University       | Zhengzhou | Han Zhonggeng  | P   |     |
|  |           | Li Bin         | P   |     |
|  |           | Lu Zhibo       |     | P   |
|  |           | Zhang Wujun    |     | H   |
| Jiading No. 1 High School                  | Jiading   | Chen Gan       | P   |     |
|  |           | Wang Yu        |     | M   |
| Jiamusi University                         | Jiamusi   | Bai Fengshan   | P   |     |
|  |           | Fan Wui        |     | P   |
|  |           | Gu Lizhi       | P   |     |
|  |           | Liu Yuhui      |     | P   |
| Jilin University of Technology             | Changchun | Fang Peichen   | M   | P   |
|  |           | Yang Yinsheng  |     | P,P |
| Jinan University                           | Guangzhou | Hu Daiqiang    |     | P   |
|  |           | Ye Shi Qi      | P   | P   |
| Nanjing Nankai University                  | Tianjin   | Liang Ke       | H   |     |
|  |           | Ruan Jishou    |     | P,P |
|  |           | Zhou Xingwei   | H   |     |
| Nanjing Normal University                  | Nanjing   | Chen Bo        |     | P   |
|  |           | Chen Xin       | P   |     |
|  |           | Fu Shitai      |     | P   |
|  |           | Zhu Qun-Sheng  | P   |     |
| Nanjing University                         | Nanjing   | Yao Tianxing   |     | H,P |
| Nanjing University of Science & Technology | Nanjing   | Wu Xingming    | P   |     |
|  |           | Xu Chun Gen    | H   |     |
|  |           | Yang Jian      | P   |     |
|  |           | Yu Jun         |     | P   |
| Nankai University                          | Tianjin   | Ke Liang       | H   |     |
|  |           | Ruan Jishou    |     | P,P |
|  |           | Zhou Xingwei   | H   |     |
| National University of Defence Technology  | Changsha  | Lu Shirong     | H   | P   |
|  |           | Wu Mengda      | H   | M   |
| North China Institute of Technology        | Taiyuan   | Lei Ying-jie   |     | P   |
|  |           | Xue Ya-kui     | P   |     |
|  |           | Yong Bi        | H   |     |

| INSTITUTION                             | CITY      | ADVISOR                        | A | B     |
|---|-----------|--------------------------------|---|-------|
| Northeastern University                 | Shenyang  | Cui Jianjiang                  |   | P     |
|   |           | Han Tie-min                    |   | P     |
|   |           | Hao Peifeng                    |   | P     |
|   |           | Xiao Wendong                   |   | M     |
|   |           | Xue Dingyu                     |   | P     |
| Northwest Inst. of Textile Sci. & Tech. | Xi'an     | He XingShi                     | P | H     |
| Northwest University                    | Xi'an     | He Rui-chan                    |   | P,P   |
| Northwestern Polytechnic University     | Xi'an     | Hua Peng Guo                   |   | H     |
|   |           | Liu Xiao Dong                  | H |       |
|   |           | Shi Yi Min                     | H |       |
|   |           | Zhang Sheng Gui                |   | P     |
| Peking University                       | Beijing   | Deng Minghua                   | P | P     |
|   |           | Lei Gongyan                    |   | H,P   |
|   |           | Shu Yousheng                   | H | H     |
| Second Aero. Inst. of the Air Force     | ChangChun | Zhang Shaohuai and<br>Fu Deyou |   | P,P   |
| Shandong University                     | Jinan     | Ma Piming                      | P |       |
|   |           | Ma Zhengyuan                   | P |       |
| Shanghai Foreign Language School        | Shanghai  | Li Qun Pan                     |   | M,P,P |
| Shanghai Jiaotong University            | Shanghai  | Huang Jianguo                  |   | P,P   |
|   |           | Song Baorui                    | H | P     |
| Shanghai Maritime University            | Shanghai  | Sheng Zining                   | P |       |
| Shanghai Normal University              | Shanghai  | Guo Shenghuan                  |   | P     |
|   |           | Zhang Jizhou                   |   | P     |
|   |           | Zhu Detong                     |   | H     |
| Shanghai Univ. of Finance and Econ.     | Shanghai  | Feng Suwei                     |   | H     |
|   |           | Yang Xiaobin                   | H |       |
| Shanxi University                       | Taiyuan   | Li Jihong                      | P |       |
|   |           | Yang Aimin                     |   | P     |
|   |           | Zhang Xianwen                  |   | P     |
|   |           | Zhao Aimin                     | P |       |
| Sichuan University                      | Chengdu   | Li Huang                       |   | P     |
|   |           | Liu Xiaoshi                    |   | P     |
|   |           | Yang Zhihe                     |   | P     |
|   |           | Zhou Jie                       | P |       |
| South China University of Technology    | Guangzhou | Liang Manfa                    |   | P     |
|   |           | Lin Jianliang                  |   | M     |
|   |           | Tao Zhisui                     |   | H     |
|   |           | Zhu Fengfeng                   | H |       |
| Southeast University                    | Nanjing   | Chen En-shui                   | M | P     |
|   |           | Huang Jun                      |   | H,H   |
| Tianjin University                      | Tianjin   | Dong Wenjun                    | M |       |
|   |           | Liu Zeyi                       | P |       |
|   |           | Wenhua Hou                     |   | P     |

| INSTITUTION                         | CITY         | ADVISOR               | A | B   |
|-------------------------------------|--------------|-----------------------|---|-----|
| Tsinghua University                 | Beijing      | Hu Zhi-Ming           | P | H   |
|                                     |              | Ye Jun                | H | H   |
| University of Elec. Science & Tech. | Chengdu      | Wang Jiagao           | P | H   |
|                                     |              | Xu Quanzhi            |   | P   |
|                                     |              | Zhong Erjie           | P |     |
| University of Sci. & Tech. of China | Hefei        | Gu Iajun              |   | M   |
|                                     |              | Yang Jian             |   | H   |
|                                     |              | Yang Liu              | P |     |
|                                     |              | Yong Ni               | P |     |
| Wuhan University (WUHEE)            | Wuhan        | Chen Gui Xing         | P |     |
|                                     |              | Huang Chongchao       |   | M   |
| Wuhan University of Tech.           | Wuhan        | Huang Zhang-Can       | P |     |
| Xi'an Inst. of Post & Telecomm.     | Xi'an        | Li Changxing and      |   |     |
|                                     |              | Fan Jiulun            |   | P   |
| Xi'an Jiaotong University           | Xi'an        | Dai Yonghong          | P |     |
|                                     |              | Zhou Yicang           | H |     |
| Xi'an University of Technology      | Xi'an        | Cao Maosheng          | P | P   |
| Xidian University                   | Xian         | Chen Hui-chan         | H |     |
|                                     |              | Liu Hong-wei          |   | H   |
|                                     |              | Zhang Zhuo-kui        | H |     |
|                                     |              | Zhou Shui-sheng       |   | P   |
|                                     |              | Wang YongMao          |   | P   |
| YanShan University                  | QinHuangDao  | Zhong XiaoZhu         | P | P   |
|                                     |              | He Yong               | M | M   |
| Zhejiang University                 | Hangzhou     | Yang Qifan            | M | M   |
|                                     |              | Bao Yun               | H |     |
| Zhongshan University                | Guangzhou    | Chen Zepeng           | M |     |
|                                     |              | Li Caiwei             | H |     |
|                                     |              | Yin Xiaoling          |   | P   |
|                                     |              |                       |   |     |
| ENGLAND                             |              |                       |   |     |
| University of Oxford                | Oxford       | Maciek Dunajski       |   | H   |
| FINLAND                             |              |                       |   |     |
| Päivölä College                     | Tarttila     | Merikki Lappi         |   | M,H |
| HONG KONG                           |              |                       |   |     |
| Hong Kong Baptist University        | Kowloon Tong | W.C. Shiu             | H |     |
|                                     |              | C.S. Tong             |   | P   |
| IRELAND                             |              |                       |   |     |
| National University of Ireland      | Galway       | Niall Madden          | P | H   |
| Trinity College Dublin              | Dublin       | Timothy G. Murphy     |   | H   |
| University College Cork             | Cork         | James Joseph Grannell | O |     |
|                                     |              | Donal J. Hurley       | H |     |
|                                     |              | Brian J. Twomey       | H |     |

| INSTITUTION                 | CITY      | ADVISOR                        | A | B   |
|-----------------------------|-----------|--------------------------------|---|-----|
| University College Dublin   | Dublin    | Peter Duffy<br>Maria G. Meehan | M | P,P |
| LITHUANIA                   |           |                                |   |     |
| Vilnius University          | Vilnius   | Ricardas Kudzma                |   | P   |
| SINGAPORE                   |           |                                |   |     |
| National Univ. of Singapore | Singapore | Lim Leong Chye Andrew          |   | M   |
| SOUTH AFRICA                |           |                                |   |     |
| Stellenbosch University     | Matieland | Jan H. van Vuuren              | O | H   |

## Editor's Note

For team advisors from China and Singapore, we have endeavored to list family name first, with the help of Susanna Chang '03.