

**Applied Risk and Decision Analysis**  
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**1. Overview**

In Year 4, the major research accomplishments in applied risk and decision analysis were:

- Technical review and advice on the development of the Risk Analysis for Informed Decisionmaking (RAPID) systems developed at the Homeland Security Institute under the auspices of the Risk Management and Analysis Division of DHS
- Support of RAPID’s threat elicitation process using intelligence analysis as experts
- Support of RAPID’s economic impact assessment process
- Continued support of the Bioterrorism Risk Assessment and the CBRN Risk Assessment conducted at S&T
- Initiation of an effort to evaluate a scaled down version of CREATE’s MANPADS model to a proposal by Northrop Grumman for use of Direct Infrared Countermeasures (DIRCMS) for high-risk flights only

**2. Research Accomplishments**

In the spring of 2008, CREATE was asked by the Director of the Risk Management and Analysis (RMA) Division of DHS to review the technical merits of RAPID. This review involved several meetings and included three CREATE researchers (Detlof von Winterfeldt, Don Kleinmuntz, and Henry Willis). RAPID is a very ambitious risk-based resource allocation system that RMA intends to apply for DHS-wide planning and budgeting. The review stated that RAPID was conceptually sound, but that there were several areas, where data was missing and hard to obtain. The review endorsed the use of expert judgment in those cases, but also warned, that lacking a sound basis for some of these judgments, the system might fail due to the poor quality of the inputs provided by experts. The review offered CREATE’s help in designing expert elicitation processes and in assessing indirect economic consequences of terrorism.

Subsequently, in the summer of 2008, CREATE supported a process for involving intelligence analysts in providing threat probabilities. This process involved four meetings and three CREATE researchers (Detlof von Winterfeldt, Steve Hora, and Henry Willis). In the first meeting, we presented the design of expert judgment processes, introduced some training materials, and provided participants with practice in expert elicitation. In the second meeting we worked with intelligence analysts to improve the proposed RAPID attack paths and to train analysts in expert elicitation. We also delivered a training manual to the RAPID team (Hora, 2008). In the third and fourth meetings, Willis and von Winterfeldt elicited probabilities of four attack scenarios from eight intelligence analysts, making sure that each probability

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judgment was elicited by at least three experts. The results of this elicitation were classified and are currently analyzed by the Homeland Security Institute and RMA team.

We also supported RAPID by summarizing existing research on indirect economic impacts of terrorism for three attack scenarios: nuclear bomb, IED attack, and attack on a chemical plant.

During Year 4, we continued our support of S&T’s Bioterrorism Risk Assessment (BTRA) and, in a minor role, supported the extension of this risk assessment to all CBRN attacks (Chemical, Biological, Radiological, Nuclear). The methodological support for BTRA is described in the advanced decision and risk analysis project. In addition, we wrote a short note on the use of probabilistic risk analysis methods for terrorism risk assessment that was written in response to some of the criticism leveled at BTRA by a National Academy of Sciences report (Ezell and von Winterfeldt, 2008).

Finally, in the fall of 2008, we were approached by Northrop Grumman with a request to apply CREATE’s MANPADS model to a scaled down version of their Counter-MANPADS device, a laser-based DIRCM. This invitation was followed by a visit at Northrop Grumman’s facility near Chicago and briefings by Northrop-Grumman staff. The idea was to deploy DIRCMs only for aircraft that fly into dangerous zones (e.g., non-military aircraft flying into Afghanistan). This project is currently still underway.

### 3. Applied Relevance

By definition, all the projects described above have a high degree of applied relevance and they were, in fact directly requested by a client, either within DHS or elsewhere. The key clients were Tina Gabrielli (Director, RMA, DHS), Steve Bennett (Director, CBRN Risk Assessment, S&T, DHS), and Jon Glassman (Vice President for External Relations, Northrop Grumman).

### 4. Collaborative Projects

Within CREATE, this project was closely related to the advanced decision analysis project and to the risk perception projects.

### 5. Research Products

<b>Research Products (Please detail below)</b>		<b>#</b>
5a	# of peer-reviewed journal reports published	0
5a	# of peer-reviewed journal reports accepted for publication	0
5a	# of non-peer reviewed publications and reports	2
5a	# of scholarly journal citations of published reports	?
5b	# of scholarly presentations (conferences, workshops, seminars)	0
5b	# of outreach presentations (non-technical groups, general public)	1
5c	# of products delivered to DHS, other Federal agencies, or State/Local	3
5c	# of patents filed	0
5c	# of patents issued	0
5c	# of products in commercialization pipeline (products not yet to market)	0
5c	# of products introduced to market	0

## 5.1. Publications and Reports

	Ref	Not Ref
1. Eppel, T., von Winterfeldt, D., "Value of Information Analysis for Nuclear Waste Storage Tanks," <i>Decision Analysis</i> , 3, 157-167, 2008	x	
2. Kavet, R., Mohan, M., von Winterfeldt, D., "A New Paradigm for Assessing the Value of Environmental Research," submitted to <i>Decision Analysis</i> , 2008	x	
3. von Winterfeldt, D., "Structuring Problems for Decision Analysis: Concepts, Tools, and an Example," <i>European Journal of Operational Research</i> , forthcoming, 2008	x	
4. Eppel, T., "Manual for the Dirichlet Elicitation Tool," <i>CREATE Report</i> , 2008		x
5. Eppel, T., "Manual for the Dirichlet Aggregation Tool," <i>CREATE Report</i> , 2008		x
6. Ezell, B. and von Winterfeldt, D. (2008) "A Note on the Use of Probabilistic Risk Analysis for Modeling Terrorist Actions," <i>CREATE Report</i> , 2008, also submitted to <i>Risk Analysis</i> .		x
7. Garcia, M., von Winterfeldt, D., "Modeling Terrorist Attacks with Dynamic and Adaptive Decision Trees: An Application to MANPADS Countermeasures," draft <i>CREATE Report</i> , 2008		x
8. Hora, S., von Winterfeldt, D., "Eliciting Split Fractions with Dirichlet Distributions," draft <i>CREATE Report</i> , 2008		x
9. Keeney, G., von Winterfeldt, D., "Al Qaeda's Values and Objectives," draft <i>CREATE Report</i> , 2008		x
10. Southwell, C., von Winterfeldt, D., "A Decision Analysis of Options to Rebuild the New Orleans Levee System," in Richardson, H., Gordon, P., Moore II, J. (eds.) <i>Risk and Economic Impacts of Hurricane Katrina</i> , London: Elgar, 34-52, 2008		x
11. von Winterfeldt, D., Note on the review of the Risk Assessment for Informed Decision making (RAPID) methodology, submitted to the Risk Management and Analysis Division, DHS, 2008		x

## 5.2. Presentations

### Conferences

- von Winterfeldt, D., "Intelligence Analysis Tasks - Risk Analysis Tools," *Intelligence and Risk Analysis Symposium*, sponsored by CREATE, HSI, and CPASS, Georgetown University, Washington, DC, December 16, 2008
- von Winterfeldt, D., "Decision Analysis with Multiple Stakeholders," *ISEE Conference 2008*, Pasadena, CA, October 13, 2008
- von Winterfeldt, D. "Should we Protect Commercial Airplanes against Surface to Missile Attacks by Terrorists?," *INFORMS National Meeting*, October 12, 2008
- von Winterfeldt, D., "Need for Behavioral and Experimental Economics Research on Terrorism," *Behavioral Economics and Terrorism Conference*, sponsored by CREATE and Wharton Risk Management and Decision Process Center, USC, Los Angeles, CA, August 16-17, 2008
- von Winterfeldt, D., "Review of Research Needs and Topics," *Behavioral Economics and Terrorism Conference*, sponsored by CREATE and Wharton Risk Management and Decision Process Center, USC, Los Angeles, CA, August 16-17, 2008
- von Winterfeldt, D., "Decision and Risk Analysis to Counter Terrorism," *Third Annual Conference on Terrorism and Global Security*, RAND Corporation, Santa Monica, May 9, 2008

- von Winterfeldt, D. “Insights from CREATE Research to Counter Terrorism,” Aspen seminar, Los Angeles, April 2, 2008
- von Winterfeldt, D., “Experiences with Risk Analysis and Implications for Bioterrorism,” University Programs Summit (DHS), Washington, DC, March 20, 2008
- von Winterfeldt, D., Decision and Risk Analysis to Counter Terrorism, invited seminar, Wharton Risk Management Center, University of Pennsylvania, Philadelphia, PA, February 26, 2008
- von Winterfeldt, D., Decision and Risk Analysis to Counter Terrorism,” invited seminar, Science and Technology Directorate, DHS, Washington, DC, February 25, 2008
- von Winterfeldt, D., “Decision and Risk Analysis to Counter Terrorism.,” London School of Economics, Advisory Board to the Operational Research Department, February 18, 2008
- von Winterfeldt, D., “Risk and Economic Analysis of Terrorism Events,” Southern California Environmental Health Science Center, Los Angeles, CA, February 1, 2008
- von Winterfeldt, D., “Structuring Decision Problems for Analysis,” special interest group for Decision Analysis, Manchester, UK, December 12, 2007
- von Winterfeldt, D., “The DHS Centers of Excellence with CREATE as an Example,” *International Security and National Resilience Conference*, London, UK, December 3-5, 2007
- von Winterfeldt, D., “Insights from Applying Decision Analysis to Homeland Security Problems,” *Annual Conference of the Institute for Operations Research and Management Science*, Seattle, WA, November 5, 2007

Outreach:

- Hora, S., von Winterfeldt, D., “Expert Judgment,” presentation at the Homeland Security Institute, Arlington, VA, 2008
- von Winterfeldt, D., “Risk and Economic Analysis of Terrorism,” presentation at the School of Policy, Planning and Development, for Board Members, USC, Los Angeles, CA, September 19, 2008
- von Winterfeldt, D., insights from CREATE research to help counter terrorism,” CREATE meeting with the Aspen Institute, USC, Los Angeles, CA, April 2, 2008
- von Winterfeldt, D., “Center for Risk and Economic Analysis of Terrorism Events,” Directors’ Meeting, *UP Summit*, Washington, DC, March 18, 2008
- von Winterfeldt, D., “Decision and Risk Analysis to Counter Terrorism,” Operational Research Group Advisory Board Meeting, London School of Economics, London, England, February 18, 2008
- von Winterfeldt, D., “Risk and Economic Analysis of Terrorism Events, Southern California Environmental Health Science Center, USC, Los Angeles, CA, February 1, 2008
- von Winterfeldt, D., “Center for Risk and Economic Analysis of Terrorism Events,” DHS Minority Serving Institutions Workshop, Fullerton, CA, November 29, 2007
- von Winterfeldt, D., “CREATE Overview - Accomplishments in 2007,” Government Advisory Council meeting, Los Angeles, CA, November 8, 2007
- von Winterfeldt, D., “Overview of CREATE,” DHS Scholars and Fellows Orientation Meeting, Washington, DC, October 6, 2007

**5.3. Models, Databases, and Software Tools and Products**

Date Delivered	Item	Agency Receiving Product	Agency POC	Commercialization Status
October 1, 2008	Dirichlet Elicitation Tool (DET)	BNBI, RMA	Michael	Delivered
October 1, 2008	Dirichlet Aggregation Tool (DET)	BNBI	Kuhlman, Gordy Garrett	Delivered

## 6. Education and Outreach Products

<b>Education and Outreach Initiatives (Please detail below)</b>	<b>#</b>
# of students supported (funded by CREATE)	1
# of students involved (funded by CREATE + any other programs)	0
# of students graduated	1
# of contacts with DHS, other Federal agencies, or State/Local (committees)	10
# of existing courses modified with new material	0
# of new courses developed	0
# of new certificate programs developed	0
# of new degree programs developed	0