I

06-9110-1088-CA

REVISION NO. 06-01
TO THE
NOTICE OF COOPERATIVE AGREEMENT AWARD
BETWEEN THE
UNIVERSITY OF DELAWARE (COOPERATOR)
AND THE
UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS)
VETERINARY SERVICES

Under the provisions of Article 18, the Cooperator and APHIS hereby mutually agree to decrease the award amount of the Fiscal Year 2006 Notice of Cooperative Agreement Award No. 06-9110-1088-CA.

The following Article is hereby revised:

ARTICLE 18 – FUNDING/EFFECTIVE PERIOD, REVISIONS, AND TERMINATION

This revision decreases the Federal award for this Agreement by ($20,803.15), for a new total of $54,196.85. It shall become effective upon final date of signature. This Agreement may be further amended at any time by mutual agreement of the parties in writing. It may be terminated following provisions of 7 CFR 3016 or 7 CFR 3019, as applicable.

It is further understood by both parties that in all other respects, the original terms, conditions, and provisions of this Agreement shall remain unchanged.

UNIVERSITY OF DELAWARE
NEWARK, DELAWARE

(b)(6) 11/19/08
Date

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
VETERINARY SERVICES

Jose R. Diez 12/01/08
Associate Deputy Administrator Date

652-9396-805 - ($20,803.15)

06-9110-1088-CA

NOTICE OF COOPERATIVE AGREEMENT AWARD
BETWEEN THE
UNIVERSITY OF DELAWARE (COOPERATOR)
AND THE
UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
VETERINARY SERVICES (APHIS)

ARTICLE 1

The purpose of this Agreement is to provide Federal financial assistance to perform scientific investigations into the physical effects of foam on broilers during mass emergency depopulation.

ARTICLE 2

Under the Farm Security and Rural Investment Act of 2002, PL 107-171, Subtitle E, Animal Health Protection, Section 10401-10418, the Secretary of Agriculture, in order to protect the agriculture, environment, economy, and health and welfare of the people of the United States by preventing, detecting, controlling, and eradicating diseases and pests of animals, is authorized to cooperate with foreign countries, States, and other jurisdictions, or other persons, to prevent and eliminate burdens on interstate commerce and foreign commerce, and to regulate effectively interstate commerce and foreign commerce.

Under 7 USC 2279g, the Animal and Plant Health Inspection Service may use a Cooperative Agreement to carry out programs to protect the nation's animal and plant resources, notwithstanding Chapter 63 of Title 31.

ARTICLE 3

The cooperating parties agree to/that:

a. The Work Plan and Financial Plan developed by the Cooperator and APHIS are incorporated into this Agreement by reference.

b. The provisions of this Agreement will not replace functions that are being conducted by the Cooperator but will supplement those activities and increase program benefits to all parties.

c. The employee(s) responsible for this work will be under the general program direction of the Cooperator and APHIS. Supervision of personnel will be provided by their employing organization, and they will be subject to their employing organizations rules and regulations.

ARTICLE 4

The Cooperator agrees to/that:

a. Designate in writing to APHIS the Cooperator's authorized representative who shall be responsible for collaboratively administering the activities conducted under this Agreement.

b. Furnish personnel, as required, to accomplish the activities outlined in the Work Plan and Financial Plan.

c. Provide funds as partial payment of expenditures incurred in carrying out the terms of this Agreement in accordance with the Work Plan and Financial Plan.

d. Submit to APHIS' authorized representative quarterly accomplishment reports on program activities outlined in the Work Plan and Financial Plan. The reports will be used by APHIS to verify compliance with provisions of this Agreement. These reports are due no later than 30 days after the end of each Federal fiscal quarter except the final report which is due no later than 90 days after the Agreement expires or terminates.

e. Submit to APHIS' authorized representative a properly certified quarterly Financial Status Report, SF269, no later than 30 days after the end of each Federal fiscal quarter and a final SF269 no later than 90 days after the Agreement expires or terminates. Any requests for an extension of time to submit the SF269 must be made in writing to APHIS' authorized representative before expiration of the initial 30 or 90 day period allowed for submitting the report. Extensions of time to submit the SF269 are subject to the discretion of APHIS' authorized representative and, if allowed, shall be provided by the authorized representative in writing.

f. Treat any program income derived under this Agreement using the Deduction Alternative in accordance with the provisions of 7 CFR 3016.25(g)(1) or 7 CFR 3019.24(b)(3), as applicable, which provides for a decrease in the financial contributions of each cooperating party to this project.

g. Submit to APHIS a properly certified Request for Advance or Reimbursement, SF270, when requesting payment for expenditures. A payment request may be submitted quarterly or more frequently; however, advance of funds will be made by APHIS in increments as indicated under 11.j of the SF270 to cover monthly disbursement needs.

h. Obtain a Dun and Bradstreet (D&B) Data Universal Numbering System (DUNS) number by calling D&B at (800) 333-0505 (most expeditious) or visiting their website at http://www.dnb.com/us. This requirement does not apply to individuals applying for assistance, unless it supports a business or non-profit organization they operate. Upon obtaining the DUNS number, the Cooperator further agrees to register in the Central Contractor Registry (CCR) by visiting their website at http://www.ccr.gov (most expeditious) or calling 888-227-2423. This registration will provide a means to receive electronic funds transfers of all payments requested on the SF-270. Cooperators without accounts at financial institutions can request waivers due to hardship because of physical or geographical barrier.

i. APHIS may withhold payments called for in Article 5.b under the conditions outlined in 7 CFR 3016.21(g) or 7 CFR 3019.22(h).

j. Comply with 7 CFR 3017, Subpart C to ensure that any sub recipients that carry out the provisions of this agreement are not debarred or suspended. Sub recipients are required to disclose if they, or any of their principals, are presently excluded or disqualified.

k. Comply with and enforce the requirements for a drug-free workplace as mandated in 7 CFR 3021, "Governmentwide Requirements for Drug-Free Workplace".

l. When transmit frequency determining devices (transmitters) are owned by the Federal Government, the Federal Government will have responsibility for frequency support (frequency authorizations for fixed locations). If Cooperator-owned devices are provided, it will be the Cooperator's responsibility to obtain frequency support by

application to the Federal Communications Commission for use of government frequencies, or to obtain non government frequencies. All radio equipment will be maintained to original factory technical specifications. Mobile radio equipment removed from service will be kept at a central location with notification made to the designated Federal official. Notification of any changes, relocation, or removal of base stations or repeater stations in the system will be made to the APHIS Radio Communications Manager at Lakewood, Colorado, who will be available for technical guidance and, if needed, make periodic trips to monitor the system.

ARTICLE 5

APHIS agrees to/that:

a. Designate an Authorized Departmental Officer's Designated Representative who shall be responsible for collaboratively administering the activities conducted under this Agreement.

b. Provide funds on an advance or reimbursable basis as partial payment of allowable, agreed-to costs incurred by the Cooperator in carrying out the terms of this Agreement in accordance with the Work Plan and Financial Plan.

c. Make advance payments, if requested by the Cooperator, monthly and upon receipt of a properly certified Request for Advance or Reimbursement, SF270.

d. Provide personnel and other resources to carry out its responsibilities as outlined in the Work Plan and Financial Plan.

e. Assist the Cooperator in selecting qualified candidates to perform activities outlined in the Work Plan and Financial Plan and provide general program direction to employees assigned to the cooperative endeavor. However, the assigned employees will remain subject to the Cooperator's rules and regulations.

f. Provide special training to carry out assignments, as mutually deemed necessary.

ARTICLE 6

This Agreement is contingent upon the passage by Congress of an appropriation from which expenditures may be legally met and shall not obligate APHIS upon failure of Congress to so appropriate. This Agreement also may be reduced or terminated if Congress only provides APHIS funds for a finite period under a Continuing Resolution.

ARTICLE 7

Actual costs incurred for unemployment insurance or equitable contributions made to a self-insured unemployment fund are allowable. APHIS does not allow payment of costs incurred for unemployment claims.

ARTICLE 8

Under 41 USC 22, no member of or delegate to Congress shall be admitted to any share or part of this Agreement or to any benefit to arise therefrom.

ARTICLE 9

As a condition of this award, the Cooperator agrees to comply with the requirements contained in the United States Department of Agriculture's "Uniform Federal Assistance Regulations" , 7 CFR 3015; "Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments", 7 CFR 3016; and/or "Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations", 7 CFR 3019; in addition to "Governmentwide Debarment and Suspension (Non-Procurement)", 7 CFR 3017; "Governmentwide Requirements for Drug-Free Workplace", 7 CFR 3021; "New Restrictions on Lobbying", 7 CFR 3018; and Office of Management and Budget regulations governing "Controlling Paperwork Burdens on the Public", 5 CFR 1320.

ARTICLE 10

APHIS reserves the right to transfer title to any equipment purchased partially or fully by the Cooperator under this Agreement with Federal funds within 120 days after this Agreement expires or terminates.

ARTICLE 11

The Cooperator has the explicit duty of notifying APHIS' authorized representative, in writing, prior to the time of application for any patent or invention which is paid for in any manner or any percentage of funds provided by APHIS. This duty is not limited to the period during the Agreement, but may arise at any time during or subsequent to the Agreement. APHIS reserves to itself a royalty-free, nonexclusive, and irrevocable right to use and authorize others to use the product or invention produced under this Agreement for Government purposes. APHIS also retains the ability to force utilization of the patented invention by designating licenses in any field of use where the patentee has failed to act with reasonable diligence.

Any royalties or equivalent income earned during the effective period of this Agreement on patents or inventions derived under this Agreement shall be considered program income and treated under the provisions of 7 CFR 3016.25(g)(1) or 7 CFR 3019.24(b)(3) as applicable.

ARTICLE 12

APHIS reserves a royalty-free, nonexclusive, and irrevocable license to exercise, and to authorize others to exercise, the rights for Federal government purposes to copyrighted materials developed under this Agreement. Subject to this license, the owner is free to exercise, preserve, or transfer all its rights. The Cooperator shall ensure that no agreement is entered into for transferring the rights which would conflict with the nonexclusive license of APHIS.

Any royalties or equivalent income earned during the effective period of this Agreement on copyrighted material derived under this Agreement shall be considered program income and treated under the provisions of 7 CFR 3016.25(g)(1) or 7 CFR 3019.24(b)(3) as applicable.

ARTICLE 13

The final draft of any funded publication or audiovisual must be submitted by the Cooperator to APHIS' authorized representative prior to final printing, editing or release of the product so that APHIS can make a determination as to whether APHIS' participation in the project will be acknowledged. APHIS, furthermore, may require that the Cooperator modify or purge any acknowledgment of its support for activities conducted under this Agreement as a result of its review of a final draft. If APHIS has not responded within 30 days of receipt of the draft, the Cooperator will be free to proceed with publication without an acknowledgment. In the event that APHIS elects not to acknowledge the product, the Cooperator agrees not to attribute sponsorship by APHIS by any means including, but not limited to, publications, interviews, new releases, etc.

When an acknowledgment is desired by APHIS, unless otherwise instructed by APHIS, the statement shall read: "This material was made possible, in part, by a Cooperative Agreement from the United States Department of Agriculture's Animal and Plant Health Inspection Service (APHIS). It may not necessarily express APHIS' views."

Additionally, any other acknowledgment by the Cooperator of APHIS support shall have the express written permission of APHIS through its representative designated under this Agreement.

ARTICLE 14

As a condition of this Agreement, the recipient assures and certifies that it is in compliance with and will comply in the course of this Agreement with all applicable laws, regulations, Executive Orders, and other generally applicable requirements including those set out in 7 CFR 3019, which hereby are incorporated in this Agreement by reference, and such other statutory provisions as are specifically set forth herein.

ARTICLE 15

In the case of any equipment or product that may be authorized to be purchased with financial assistance provided using funds made available under the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act for the current Federal fiscal year, it is the sense of the Congress that entities receiving the assistance should, in expending the assistance, purchase only American-made equipment and products.

ARTICLE 16

The funding period is the period during which this Agreement is in effect. Any funds not obligated by the Cooperator during the funding period will revert to APHIS upon the expiration or termination of this funding period. Under 7 CFR 3019.25 or 7 CFR 3016.30, this Agreement is subject to a one-time extension of up to 12 months to complete this project. The Cooperator must submit a written request including an SF-424, Application for Federal Assistance, to extend the duration to be received by APHIS at least 10 days prior to the expiration of the funding period. The SF-424 must be accompanied by a justification explaining the reason for program delays, the program impact without the extension, and the anticipated completion date. During the extension period, financial and progress reports will continue with the same frequency as provided in the original funding period. As stated in 7 CFR 3019.25 or 7 CFR 3016.30, requests for extension purely to obligate funds will be denied by APHIS.

Additionally, APHIS may, upon written request to APHIS by the Cooperator at least 10 days prior to the expiration of the funding period, allow a no cost extension to extend the due date for any financial or progress reports, as required under this Agreement and supporting Federal Regulations, for a period of time to be determined by APHIS.

ARTICLE 17

No person in the United States shall be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination in programs or activities funded in whole or in part by the United States Department of Agriculture based on race, color, national origin, age, disability, and, where applicable, sex, religion or political beliefs.

ARTICLE 18

The Federal award for this Agreement is in the amount of $75,000. It shall become effective upon date of final signature and shall continue one year from the effective date subject to continuation in writing by mutual agreement of the parties. Further, this Agreement may be amended at any time during the effective period by mutual agreement of the parties in writing. It may be terminated following provisions of 7 CFR 3016 or 7 CFR 3019, as applicable.

UNIVERSITY OF DELAWARE

(b)(6)

9.28.06
Date

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
VETERINARY SERVICES

Dana Hubert 9.29.06
Associate Deputy Administrator Date

652-9396-805/$75,000
06-9110-1088-CA

APPLICATION FOR FEDERAL ASSISTANCE

Version 7/03

		2. DATE SUBMITTED	Applicant Identifier 06-9110-1088-CA
1. TYPE OF SUBMISSION: Application ☐ Construction ☑ Non-Construction	Pre-application ☐ Construction ☐ Non-Construction	3. DATE RECEIVED BY STATE	State Application Identifier
		4. DATE RECEIVED BY FEDERAL AGENCY	Federal Identifier

5. APPLICANT INFORMATION

Legal Name: University of Delaware	Organizational Unit: Department: Bioresources Engineering
Organizational DUNS: 05-900-7500	Division: College of Agriculture and Natural Resources
Address: Street: Office of the Vice Provost for Research 210 Hullihen Hall	Name and telephone number of person to be contacted on matters involving this application (give area code) 5 U.S.C. § 552 (b) (6)
City: Newark	
County: New Castle	
State: Delaware / Zip Code: 19716	
Country: USA	
6. EMPLOYER IDENTIFICATION NUMBER (EIN): 51-6000297	Phone Number (give area code) 302-831-0256 / Fax Number (give area code) 302-831-6758

8. TYPE OF APPLICATION: ☑ New ☐ Continuation ☐ Revision. If Revision, enter appropriate letter(s) in box(es) (See back of form for description of letters.) ☐ ☐ Other (specify)	7. TYPE OF APPLICANT: (See back of form for Application Types) J. Private University. Other (specify)
	9. NAME OF FEDERAL AGENCY: USDA-APHIS
10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: 10-025. TITLE (Name of Program): Plant Pests & Animal Disease	11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT: Scientific Investigation into the Physical effects of foam on broilers during mass emergency depopulation
12. AREAS AFFECTED BY PROJECT (Cities, Counties, States, etc.): Delaware	
13. PROPOSED PROJECT: Start Date: 10/1/2006 / Ending Date: 9/30/2007	14. CONGRESSIONAL DISTRICTS OF: a. Applicant At-Large / b. Project At-Large

15. ESTIMATED FUNDING:		16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?
a. Federal	$ 75,000.00	a. Yes. ☐ THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON DATE:
b. Applicant	$ .00	
c. State	$ .00	
d. Local	$ .00	b. No. ☑ PROGRAM IS NOT COVERED BY E. O. 12372
e. Other	$ .00	☐ OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW
f. Program Income	$ .00	17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?
g. TOTAL	$ 75,000.00	☐ Yes If "Yes" attach an explanation. ☐ No

18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT. THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED.

a. Authorized Representative

Prefix: Mrs.	First Name: Nancy	Middle Name
Last Name: Rash		Suffix
b. Title: Contract and Grant Administrator		c. Telephone Number (give area code): 302-831-4978
d. Signature of Authorized Representative (b)(6)		e. Date Signed: 10-6-06

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Standard Form 424 (Rev.9-2003)
Prescribed by OMB Circular A-102

BUDGET INFORMATION - Non-Construction Programs

OMB Approval No. 0348-0044

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1.		$	$	$ 75,000.00	$	$ 75,000.00
2.						0.00
3.						0.00
4.						0.00
5. Totals		$ 0.00	$ 0.00	$ 75,000.00	$ 0.00	$ 75,000.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1)	(2)	(3)	(4)	Total (5)
a. Personnel	$ 31,611.00	$	$	$	$ 31,611.00
b. Fringe Benefits	3,838.00				3,838.00
c. Travel	3,000.00				3,000.00
d. Equipment	11,400.00				11,400.00
e. Supplies	18,369.00				18,369.00
f. Contractual					0.00
g. Construction					0.00
h. Other	1,000.00				1,000.00
i. Total Direct Charges *(sum of 6a-6h)*	69,218.00	0.00	0.00	0.00	69,218.00
j. Indirect Charges	5,782.00				5,782.00
k. TOTALS *(sum of 6i and 6j)*	$ 75,000.00	$ 0.00	$ 0.00	$ 0.00	$ 75,000.00
7. Program Income	$	$	$	$	$ 0.00

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Standard Form 424A (Rev. 7-97)
Prescribed by OMB Circular A-102

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SECTION C - NON-FEDERAL RESOURCES				
(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	$	$	$	$ 0.00
9.				0.00
10.				0.00
11.				0.00
12. TOTAL *(sum of lines 8-11)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 75,000.00	$ 18,750.00	$ 18,750.00	$ 18,750.00	$ 18,750.00
14. Non-Federal	0.00				
15. TOTAL *(sum of lines 13 and 14)*	$ 75,000.00	$ 18,750.00	$ 18,750.00	$ 18,750.00	$ 18,750.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT				
(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.	$	$	$	$
17.				
18.				
19.				
20. TOTAL *(sum of lines 16-19)*	$ 0.00	$ 0.00	$ 0.00	$ 0.00

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges:	22. Indirect Charges:
23. Remarks:	

Budget justification

Salaries and Wages
Funds are requested to 5 U.S.C. § 552 (b) (6) , a faculty member with a 9 month appointment, for one month of summer salary.

No funds are requested to support 5 U.S.C. § 552 (b) (6)
for their involvement in the activity at UD. No funds are requested to support A. Bruce Webster at the University of Georgia. The principle investigators will commit 1% effort to meet the minimum matching requirement. Their actual commitment to the project may be higher.

Support a graduate student ($20,000) and for undergraduate research students ($3,500) is requested to assist in the listed experiments.

Fringe Benefits
University of Delaware Fringe benefit rates are 34% for faculty, staff and technicians, 4% for the graduate student and 8% for undergraduate students.

Travel
Travel funds ($3,000) are requested for local travel to and from test site, PI travel to research sites, and/or meeting with USDA representatives.

Materials and Supplies
The consumable supplies for Objective A will include high intensity lamps, dye, birds and similar ($3,908).

The consumable supplies for Objective B ($2,218) will include raising birds to 42 days, foam, CO_2 gas, EEG and ECG electrodes.

The consumable supplies for Objective C will include development of the model, equipment to vary the bubble size of the foam and validation with birds ($7,537).

Instrumentation will be required for the laboratory and scaling trials. Purchase of Data Sciences International small animal telemetry system with ECG and EEG output is estimated at $11,400. Instrumentation to include a Telaire 7001 Data Logger Kit, HOBO 4-Channel External Data Loggers, appropriate software, a CO_2 sensor, O_2 sensors and diffusion tubes are required for the project ($2,732).

Publication Costs
Support for publication and dissemination of results in one scientific journal (Poultry Science, Journal of Applied Poultry Research or equivalent) ($1,000).

Indirect Costs
The federally negotiated indirect cost rate for a research proposal in the College of Agriculture and Natural Resources is 29%.

OMB Approval No. 0348-0040

ASSURANCES - NON-CONSTRUCTION PROGRAMS

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.

2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.

3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.

4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.

5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).

6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.

7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.

8. Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

9. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.

10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is $10,000 or more.

11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).

12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.

13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).

14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.

15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.

16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.

17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."

18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

	TITLE
(b)(6)	Contract & Grant Administrator
APPLICANT ORGANIZATION	DATE SUBMITTED
University of Delaware	September 26, 2006

Scientific investigation into the physical effects of foam on broilers during mass emergency depopulation

Cooperative Agreement

Principal Investigators:
University of Delaware
5 U.S.C. § 552 (b) (6)

5 U.S.C. § 552 (b) (6)

and Food Science

5 U.S.C. § 552 (b) (6)

Department of Animal and Food Science

5 U.S.C. § 552 (b) (6)

Department of Animal and Food Science

5 U.S.C. § 552 (b) (6)

Department of Bioresources Engineering

University of Georgia

5 U.S.C. § 552 (b) (6)

Cooperative Agreement

Introduction

A novel process of using foam for mass emergency depopulation of meat type birds is currently under development. The process appears to be much faster to implement, causes faster death in birds, being more biosecure and expose fewer personnel to potentially zoonotic viruses. Although the process has advantages, questions regarding the welfare aspects of this process remain.

In the initial experiments, loss of posture and cessation of activity were monitored manually. Manual measurements introduced error and more systematic means of measurement were introduced.

In previous experiments, the heart rate was monitored using ECG on select birds in the system. The ECG results were used to determine cessation of activity and the actual rate portion was not used for evaluation.

Although the bird dies relatively rapidly, a consistent question has been how rapidly the birds become unconscious. The ECG data does not indicate consciousness. In addition, in poultry, the heart can continue to pump well after brain activity has ceased.

Objectives

A. Investigate and/or develop alternative means of viewing the response of birds within the foam.
B. Measure and compare EEG and ECG results for birds for birds undergoing anoxia via foam, CO_2, nitrogen and/or argon based depopulation.
C. Modeling and evaluation of bubble size in commercial poultry

Objective A:
Investigate and/or develop alternative means of viewing the response of birds within the foam.

Justification:
Animal welfare can be evaluated both qualitatively and quantitatively. Quantitative measures include heart rate, brain activity and/or corticosterone steroid levels. Qualitative measures include observations of terminal activity (wing flapping, vocalization or similar) during treatment. Unfortunately, fire fighting foam acts as a visual impediment to viewing the activity of the birds.

Methods and Materials:
To support Objective A, a polycarbonate chamber will be filled with foam in a light controlled room. Two methods of viewing the bird (silhouette and thermal imaging) will be evaluated and then used during treatment.

Commercial broilers will be used during Objective A. The broilers will be between five and eight weeks of age and will be raised under typical conditions.

In silhouetting, the contrast between the bird and the background will be maximized. Multiple bright spotlights will be used to increase the contrast between the bird and the background. Multiple video cameras will be positioned to view the chamber from at least two sides and one of either the top or bottom. Dye may be added to the bird and or foam to maximize the contrast between the bird and foam. In the second treatment, thermal imaging equipment and technology available through USDA Animal Care will be used to view the birds under foam. Thermography has been successfully applied to other animal health and welfare applications (Eddy, et al., 2001). Thermal cameras detect differences in temperature between the target and surroundings. To improve visualization of the birds, it may be necessary to maximize the difference in temperature between the bird and the surrounding foam. Since the temperature of the bird is not easily altered, the temperature of the water may be reduced to improve visualization of the birds. An infrared spotlight may be used to improve visualization of the birds. Eddy et al., (2001) suggest that thermography should be done in a draft-free environment with low light, a temperature less than 30 C and after a 10 – 20 minute acclimation period.

The treatments will be evaluated by placing a broiler within the chamber and filling the chamber with foam to a level suitable to cover the body, but not cause head coverage. This will allow the same bird to be used for testing over a several hour period.

After determining the suitability of both conventional video and thermal imaging, one method will be selected for depopulation testing. Three depopulation treatments (foam, CO_2, and argon or nitrogen gas) will be used. Each bird will be exposed to one treatment only and standard protocols for each treatment will be followed. Gas concentration levels will be recorded at 60 s using GasTec and/or Drager dosimeter tubes. Oxygen sensors (OxyCheq or equivalent) may be located inside the chamber to determine O_2 level. Temperature sensors may be located within the chamber as well. Electronic sensors will be recorded using National Instruments LabVIEW software. Cessation of activity will be measured by ECG and/or accelerometers located on the bird. During depopulation testing, one bird will be placed within the chamber and treatment applied to the bird. Up to fifteen replications per treatment will be performed.

A total of 45 birds are required for the experiment. There will be three treatments with up to fifteen birds per treatment required to ensure statistical validity.

Objective B:
Measure and compare EEG and ECG results for birds for birds undergoing anoxia via foam, CO_2, nitrogen and/or argon based depopulation.

Justification:
In previous experiments, ECG sensors were used to record the cessation of activity from birds treated with CO_2 or fire fighting foam. ECG can be used to monitor the heart rate and to determine when heart activity ceased. The foam procedure causes relatively rapid cessation of activity, but raises questions as to how long the bird is aware during treatment.

Methods and Materials:
To support Objectives B, EEG and ECG equipment will be used to simultaneously monitor brain and heart activity. A wireless telemetry system (DataScience International DQ ART 4.0 or equivalent) will be used to monitor brain activity. An existing tethered telemetry system (BIOPAC Systems, Inc. Student Laboratory edition or equivalent) will be used to monitor heart activity.

Three treatments, a foam depopulation technology, CO_2 polyethylene and argon gas, will be used. The foam depopulation technology may be chosen from the Kifco style foam generator system, medium expansion foam generator and/or reduced scale systems appropriate for laboratory use. Dye may be added to the foam to improve visualization of the movement of the foam within the bird. Ten six week old broiler chickens will be depopulated per treatment, for a total of thirty birds for the experiment. Treatment will occur within a polycarbonate chamber or similar.

Commercial broilers will be used during Objective B. The broilers will be between five and eight weeks of age and will be raised under typical conditions.

Gas flow rates and flow times will be recorded. Bird activity will be monitored using a PCB Piezioelectric accelerometer 352C66 or similar attached to the right leg. Carbon dioxide levels will be recorded at 60 s using GasTec 0 – 100% CO_2 dosimeter tubes. Oxygen sensors (OxyCheq or equivalent) may be located inside the chamber to determine O_2 level. Temperature sensors may be located within the chamber as well. Electronic sensors will be recorded using National Instruments LabVIEW software.

A wireless telemetry implant (Data Science International TA10EA-F20 or equivalent) will be implanted in the broiler prior to testing (Savory and Kostal, 2006; Savory and Kostal, 1997). The implant will be sterilized using a cold chemical sterilization liquid (Cidex® (Johnson & Johnson Company), Actril® (Minntech Corporation), NuCidex® (Johnson & Johnson Company) or equivalent) prior to the procedure. Anesthesia will be induced using 2% halothane in 100% oxygen at 2 l/min flow rate, and maintained during surgery with 1.5% halothane at 1.5 l/min or using a similar accepted anesthesia procedure. The chicken will be secured on the operating table and a 6-cm incision made in the skin from the left knee towards the cloaca, parallel to the femur will be made. An incision will be made in the outer muscle layer of the left abdominal wall, and a cavity created between the outer and inner layers for holding the main body of the implant. Using a long pair of blunt forceps and with an intermediate entry hole in the skin at the base of the neck, the biopotential leads will be pulled under the skin along the back, and then up the neck to emerge at the back of the head. After exposing the posterior skull, the bone there will be scraped and 2 holes 1 cm apart and 1.5 cm behind the comb will be drilled through the bone with a hand-held 1.7 mm diameter bit, to expose the surface of the telencephalon. The leads will be cut to an appropriate length, their exposed ends bent through 90 degrees and inserted in the holes and anchored in position using dental acrylic with the tips of the sensing electrodes touching the telencephalon. The operation areas will be treated with antibiotics, the skin incisions closed and the chicken will be allowed to recover on with 100% oxygen for 10 min. While the bird is under anesthesia, areas on the wing and body will be plucked and prepared for ECG surface pad sensors. Birds will be allowed to recover for a minimum of 24 hours before depopulation. The output from the radiotelemetry system will be checked prior to beginning any depopulation work.

On the day of treatment, ECG pads will be affixed to the bird in the prepared locations. The birds will be placed in a polycarbonate chamber equipped with Data Sciences International RPC-1 antenna or equivalent. Output from the EEG and ECG sensors will be checked prior to beginning treatment. Treatments will be randomized to avoid testing effects. Multiple video cameras will be located to record the activity of the bird. Prior to treatment, EEG and ECG baseline data recording will begin.

The heart rate, blood pressure, body temperature, and relative powers in delta (1–4 Hz), theta (4–8 Hz), alpha (8–12 Hz) and beta (12–30 Hz) frequency bands of the EEG power spectrum data will be analyzed using ANOVA to determine the effect of treatment. EEG results with obvious anomalous peaks or major deviations in baselines will be excluded from the analysis (Savory and Kostal, 2006).

A total of 45 birds are required for the experiment. There will be three treatments with up to fifteen birds per treatment required to ensure statistical validity.

Additional Notes:
Disturbances of the circadian rhythm of animals can help to indicate distress in animals. There is some research to suggest that it may take up to two weeks for the circadian rhythm to return to normal following implantation surgery (Bastlund, et al., 2004). Although the implantation of the procedure is relatively invasive procedure, this should not cause a problem for the type of measurements desired in this study, which will look at treatment to treatment variation rather than absolute measurements. If necessary, the time between implantation and treatment can be increased, however, with a limited number of implantable transmitters, this will increase the amount of time required for the study.

Objective C:
Modeling and evaluation of bubble size in commercial poultry

Justification:
Several different foam technologies have been developed and evaluated. Intuitively, there should be an ideal bubble size for different types of birds. Although different foam technologies have been tested, the relationship between bird age and type and required bubble size has not been determined.

Methods and Materials:
To evaluate the impact of bubble size, trachea measurements will be collected from poultry species of commercial interest. Trachea measurements will be obtained from three to five birds of both young and market age commercial broiler (commercial), turkey (large white commercial hens) and ducks (white pekin). The definition of each age will vary by species as shown in Table 1. Additional species will be collected on an as available basis. During the initial trachea measurement stage, the goal is to develop realistic ranges of trachea sizes expected for each species.

Table 1. Projected Bird Ages for trachea measurements and/or validation testing.

Bird	Young	Moderate	Market
Broiler	2 – 3 weeks	5 – 6 weeks	7 – 8 weeks
Turkey	2 – 3 weeks	7 – 8 weeks	14 – 16 weeks
Duck	2 – 3 weeks	4 – 5 weeks	6 – 7 weeks

The birds will be euthanized with 100% carbon dioxide or suitable alternative euthanasia procedure to minimize damage (i.e. lesions or similar) to the upper respiratory system. Necropsy will be performed and measurements collected.

Measurements of the trachea will be collected following the procedure of Loewen and Walner (2000). During necropsy, the airway will be excised from the epiglottis to mainstem bronchi. Specimens will be traversely cut to the desired level and cross-sectional diameters (lateral, ventral) will be measured using digital calipers (Mitutoyo digital caliper or equivalent). Longitudinal measurements of the airway will be collected simultaneously.

A model avian respiratory tract will be used to determine the appropriate bubble size required for each species. A model avian respiratory tract will be created from the measurements determined above. The procedures described in Bayly and Slocombe (1997) will be used to create a model respiratory system. The trachea tubes in the model will be constructed from glass and/or plastic tube and will be varied based on the dimensions determined from measurements collected from broiler, turkey and ducks as described above. A variable volume piston pump will be used to draw air and foam through the system. Air flow rate and vacuum pressure will be measured using rotameter and differential pressure transducers. Air flow rate will be based on recommended inhalation anesthetic rates.

Foam has been reliable manufactured in small scale using user refillable foam fire extinguishers (Amerex AMEREX 250 CG or equivalent). The fire extinguisher will be modified with replaceable screen inlets to alter the size and bubble content of the foam. Foam will be systematically created in different bubble sizes in the laboratory, measured and tested in the model. The optimal foam sizes will be determined from the model.

The optimal foam sizes will be validated using the Kifco style foam generator system, medium expansion foam generator and/or reduced scale systems appropriate for laboratory use. Validation will be carried out on birds of young, moderate and market age for broilers, turkeys and ducks as shown in Table 1. A minimum of three birds per age group will be used to ensure statistical validity. Dye may be added to the foam to improve visualization of the movement of the foam within the bird. Treatment will occur within a polycarbonate chamber or similar. Cessation of activity will be measured by ECG and/or accelerometers located on the bird. Any birds that are unsuccessfully treated with foam will be euthanized with 100% carbon dioxide.

The foam size will be measured prior to bird validation. Bubble size will be measured using machine vision based on the methods of Pugh (2005). Foam will be collected between two glass plates separated by a narrow spacing (1 – 5 mm). The glass plates will include scaling values to allow the images to be converted from pixel measurements to physical measurements. Spotlights used in Objective A will be used to illuminate the glass and digital images will be collected of the foam samples. A standardized image collection platform and tripod will be used. Existing digital cameras will be used. Images will be collected and analyzed using Mathworks MATLAB and/or National Instruments LabVIEW.

After foam treatment, birds will be necroscopied. During necropsy, the anatomic site along the trachea where the foam bubbles occur will be recorded. In addition, during foam validation necropsy, duplicate trachea measurements will be collected using the previously described procedure.

A total of 90 birds are required for the experiment. Two sets of birds are required, one for initial trachea measurements, the second for validation. Three to five birds are required for each age x species.

References:

Bastlund, J.F., P. Jennum, P. Mohapel, V. Vogel and W.P. Watson. Measurement of cortical and hippocampal epileptiform activity in freely moving rats by means of implantable radiotelemetry. Journal of Neuroscience Methods 138 (2004): 65–72.

Eddy,. A.L., L.M. Van Hoogmoed and J.R. Snyder. 2001. The role of thermography in the management of equine lameness. The Veterinary Journal 162: 172-181.

Loewen, M.S., and D.L. Walner. 2000. Dimensions of rabbit subglottis and trachea. Laboratory Aniamls (2001) 35: 253-256.

Mumford, H., and J.R. Wetherell. 2001. A simple method for measuring EEG in freely moving guinea pigs. Journal of Neuroscience Methods 107(2001): 125-130.

Savory, C.J., and L. Kostal. 2006. Is expression of some behaviours associated with de-arousal in restricted-fed chickens? Physiology & Behavior 88 (2006) 473–478.

Savory, C.J., and L. Kostal. 1997. Application of a Radiotelemetry System for Chronic Measurement of Blood Pressure, Heart Rate, EEG, and Activity in the Chicken, Physiology & Behavior, 61(6): 963-969.

Pugh, R.J. Experimental techniques for studying the structure of foams and froths. Advances in colloid and interface science. 114-115: 239-251.

CONTINUATION
TO THE
NOTICE OF GRANT AWARD
BETWEEN THE
UNIVERSITY OF DELAWARE (COOPERATOR)
AND THE
UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS)
ANIMAL CARE

Under the provisions of Article 17, Notice of Grant Award No. 08-6100-0032-GR is hereby continued for Fiscal Year 2009. All terms and conditions of this Agreement are presented below.

ARTICLE 1 - PURPOSE

The purpose of this Agreement is to provide Federal financial assistance to evaluate the use of water based foam with and without inert gas for depopulation of broilers and leghorns, evaluate the use of water based foam with and without inert gas for depopulation of turkeys, develop a valid foam field testing strategy, evaluate the impact of variable water conditions on foam generation, and maintain and update an educational module on foam depopulation.

ARTICLE 2 – AUTHORITIES

Under the Farm Security and Rural Investment Act of 2002, PL 107-171, Subtitle E, Animal Health Protection, Section 10401-10418, the Secretary of Agriculture, in order to protect the agriculture, environment, economy, and health and welfare of the people of the United States by preventing, detecting, controlling, and eradicating diseases and pests of animals, is authorized to cooperate with foreign countries, States, and other jurisdictions, or other persons, to prevent and eliminate burdens on interstate commerce and foreign commerce, and to regulate effectively interstate commerce and foreign commerce.

ARTICLE 3 – MUTUAL UNDERSTANDINGS AND RESPONSIBILITIES

The cooperating parties agree to/that:

a. A mutually satisfactory annual Work Plan and Financial Plan developed by the Grantee and APHIS are incorporated into this Grant by reference.

b. The provisions of this Grant will not replace functions that are being conducted by the Grantee but will supplement those activities and increase program benefits to all parties.

c. The employee(s) responsible for this work will be under the general program direction of the Grantee and APHIS. Supervision of personnel will be provided by their employing organization, and they will be subject to their employing organizations rules and regulations.

ARTICLE 4 – GRANTEE RESPONSIBILITIES

The Grantee understands and agrees to/that:

a. 5 U.S.C. § 552 (b) (6) its authorized representative who shall be responsible for collaboratively administering the activities conducted under this Grant.

b. Furnish personnel, as required, to accomplish the activities outlined in the Work Plan and Financial Plan.

c. Submit to APHIS' authorized representative properly certified **quarterly** accomplishment reports on activities outlined in the Work Plan and Financial Plan. The reports will be used by APHIS to verify compliance with provisions of this Agreement. They are due:

First Quarter: April 30, 2009
Second Quarter: July 30, 2009
Third Quarter: October 30, 2009
Final: No later than 90 days after the Agreement expires or terminates.

Any requests for an extension of time to submit the reports must be justified and made in writing to APHIS' authorized representative before expiration of the initial 30 or 90 day period allowed for submitting the report. Extensions of time to submit the reports are subject to the discretion of APHIS' authorized representative and, if allowed, shall be provided by the authorized representative in writing. When an agreement includes multiple projects covered by multiple Work Plans and Financial Plans, each project must be reported separately.

d. Submit to APHIS' authorized representative properly certified **quarterly** Federal Financial Reports (FFR). They are due:

First Quarter: April 30, 2009
Second Quarter: July 30, 2009
Third Quarter: October 30, 2009
Final: No later than 90 days after the Agreement expires or terminates

Any requests for an extension of time to submit the FFR must be justified and made in writing to APHIS' authorized representative before expiration of the initial 30 or 90 day period allowed for submitting the report. Extensions of time to submit the FFR are subject to the discretion of APHIS' authorized representative and, if allowed, shall be provided by the authorized representative in writing. In addition, APHIS requires a separate FFR for each award. When an agreement includes multiple projects covered by multiple Work Plans and Financial Plans, each project must be reported on a separate FFR. **Further, all federal funds reflected as unobligated on the final FFR will no longer be available for obligation by the Grantee**

e. Treat any program income derived under this Agreement using the Deduction Alternative in accordance with the provisions of 3019.24(b) (3) which provides for a decrease in the financial contributions of each cooperating party to this project.

f. Submit to APHIS a properly certified Request for Advance or Reimbursement, SF-270, when requesting payment for expenditures. A payment request may be submitted quarterly or more frequently; however, advance of funds will be made by APHIS in increments as indicated under 11.j of the SF-270 to cover monthly disbursement needs.

g. Obtain a Dun and Bradstreet (D&B) Data Universal Numbering System (DUNS) number by calling D&B at (800) 333-0505 (most expeditious) or visiting their website at http://www.dnb.com/us. This

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requirement does not apply to individuals applying for assistance, unless it supports a business or non-profit organization they operate. Upon obtaining the DUNS number, the Grantee further agrees to register in the Central Contractor Registry (CCR) by visiting their website at http://www.ccr.gov (most expeditious) or calling 888-227-2423. The Grantee also agrees to update the CCR information as necessary and to **renew the registration annually prior to its expiration date.** This registration will provide a means to receive electronic funds transfers of all payments requested on the SF-270. Grantees without accounts at financial institutions can request waivers due to hardship because of physical or geographical barrier.

h. APHIS may withhold payments called for in Article 5.b under the conditions outlined in 7 CFR 3019.22(h).

i. Comply with 7 CFR 3017, Subpart C to ensure that any subrecipients that carry out the provisions of this Agreement are not debarred or suspended. Subrecipients are required to disclose if they, or any of their principals, are presently excluded or disqualified.

j. Comply with and enforce the requirements for a drug-free workplace as mandated in 7 CFR 3021, "Governmentwide Requirements for Drug-Free Workplace".

k. Comply with and enforce the requirements in 7 CFR 3018.110 (d) (1) and (2) for completion of the Certification Regarding Lobbying and the SF-LLL, Disclosure of Lobbying Activities. Such certifications and disclosures apply to the Cooperator and any subgrants and subcontracts exceeding $100,000.

l. Maintain an inventory control system of property purchased by the Grantee in whole or in part with Federal funds as required in the Section entitled "Equipment" of 7 CFR 3019.34. Grantees shall conduct a physical inventory at least every two years and make available, as requested, the required records for review by APHIS. A copy of the reconciled final inventory report will be provided to APHIS as stated in Article 10 of this Agreement.

m. Provide an annual inventory report of any Federally-owned or Federally-leased equipment on loan to the Cooperator.

n. When the Federal share of total project costs as reflected in the Financial Plan is over $100,000 and a cumulative transfer among direct cost categories is in excess of ten percent of the current approved total budget, the Grantee will request written prior approval for the budget revision. The Grantee will submit a revised SF-424A, Budget Information, and detailed Financial Plan under a cover letter to the APHIS awarding official containing a narrative justification for the proposed revision. Transfers of funds among programs, functions, or activities as indicated in Section B of the SF-424A is prohibited.

o. Comply with the requirements for coordination, development, and use of geospatial data as mandated in OMB Circular A-16, "Coordination of Geographic Information and Related Spatial Data Activities".

p. Meet the reporting requirements of the Federal Funding Accountability and Transparency Act by providing the following information. Parent organization DUNS number; primary place of performance street address, city, county, state, country and zip code; indicate if performance is in multiple counties and/or states; and provide any comments that might be relevant. APHIS will provide a supplemental sheet for the Cooperator's convenience in recording this information.

q. Pursuant to 31 USC 3706 and 7 CFR, Part 3, Subpart B, any funds paid to a cooperator in excess of the amount to which the cooperator is finally determined to be entitled under the terms and conditions of the

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award constitute a debt to the Federal Government. If not paid within a reasonable period after the demand for payment, the Federal awarding agency my reduce the debt by:

(1) Making an administrative offset against other requests for reimbursements.
(2) Withhold advance payments otherwise due to the Cooperator
(3) Taking other action permitted by statute.

Except as otherwise provided by law, the Federal awarding agency shall charge interest on an overdue debt in accordance with 4 CFR, Chapter II "Federal Claims Collection Standards" and 31 USC, Chapter 37.

r. Any information furnished to APHIS under this Grant is subject to the Freedom of Information Act (5 USC 552).

s. As a condition of this grant or cooperative agreement, the recipient assures and certifies that it is in compliance with and will comply in the course of the agreement with all applicable laws, regulations, Executive Orders and other generally applicable requirements, including those set out in 7 CFR 3015.205(b), which hereby are incorporated in this agreement by reference, and such other statutory provisions as are specifically set forth herein.

ARTICLE 5 – APHIS RESPONSIBILITIES

APHIS agrees to/that:

a. Designate Dr. Darrel Styles as its Authorized Departmental Officer's Designated Representative who shall be responsible for collaboratively administering the activities conducted under this Agreement.

b. Provide funds on an advance or reimbursable basis as payment of allowable, agreed-to costs incurred by the Cooperator in carrying out the terms of this Agreement in accordance with the Work Plan and Financial Plan.

c. Make advance payments, if requested by the Cooperator, monthly and upon receipt of a properly certified Request for Advance or Reimbursement, SF270.

d. Provide personnel and other resources to carry out its responsibilities as outlined in the Work Plan and Financial Plan.

e. Upon receipt of the final Federal Financial Report, provide written notification to the cooperator that the balance of Federal funds reported as unobligated will no longer be available to the Cooperator.

ARTICLE 6 – AVAILABILITY OF FUNDING

This **Grant** is contingent upon the passage by Congress of an appropriation from which expenditures may be legally met and shall not obligate APHIS upon failure of Congress to so appropriate. This **Grant** also may be reduced or terminated if Congress only provides APHIS funds for a finite period under a Continuing Resolution.

ARTICLE 7 – UNEMPLOYMENT COMPENSATION

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Actual costs incurred for unemployment insurance or equitable contributions made to a self-insured unemployment fund are allowable. APHIS does not allow payment of costs incurred for unemployment claims.

ARTICLE 8 – CONGRESSIONAL RESTRICTION

Under 41 USC 22, no member of or delegate to Congress shall be admitted to any share or part of this Grant or to any benefit to arise therefrom.

ARTICLE 9 – APPLICABLE REGULATIONS

As a condition of this award, the Grantee agrees to comply and require subrecipients to comply with the requirements contained in the United States Department of Agriculture's "Uniform Federal Assistance Regulations", 7 CFR 3015; "Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments", 7 CFR 3016; and/or "Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations", 7 CFR 3019; in addition to "Governmentwide Debarment and Suspension (Non-Procurement)", 7 CFR 3017; "Governmentwide Requirements for Drug-Free Workplace", 7 CFR 3021; "New Restrictions on Lobbying", 7 CFR 3018; and Office of Management and Budget regulations governing "Controlling Paperwork Burdens on the Public", 5 CFR 1320.

ARTICLE 10 – TITLE TO EQUIPMENT

APHIS reserves the right to transfer title to any equipment purchased partially or fully by the **Grantee** under this **Grant** with Federal funds within 120 days after receipt of the final inventory which is due 90 days after the end of the Federal support of the project for which it was acquired. Upon transfer of title, the Cooperator will be entitled to compensation equal to its percentage of participation in the purchase of the equipment in the year purchased, applied to the fair market value in the year title is transferred.

ARTICLE 11 – PATENTS AND INVENTIONS

The **Grantee** has the explicit duty of notifying APHIS' authorized representative, in writing, prior to the time of application for any patent or invention which is paid for in any manner or any percentage of funds provided by APHIS. This duty is not limited to the period during the **Grant**, but may arise at any time during or subsequent to the **Grant.** APHIS reserves to itself a royalty-free, nonexclusive, and irrevocable right to use and authorize others to use the product or invention produced under this **Grant** for Government purposes. APHIS also retains the ability to force utilization of the patented invention by designating licenses in any field of use where the patentee has failed to act with reasonable diligence.

ARTICLE 12 – COPYRIGHTS

APHIS reserves a royalty-free, nonexclusive, and irrevocable license to exercise, and to authorize others to exercise, the rights for Federal government purposes to copyrighted materials developed under this **Grant.** Subject to this license, the owner is free to exercise, preserve, or transfer all its rights. The **Grantee** shall ensure that no agreement is entered into for transferring the rights which would conflict with the nonexclusive license of APHIS.

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ARTICLE 13 – PUBLICATIONS AND AUDIOVISUALS

The final draft of any funded publication or audiovisual must be submitted by the Grantee to APHIS' authorized representative prior to final printing, editing or release of the product so that APHIS can make a determination as to whether APHIS' participation in the project will be acknowledged. APHIS, furthermore, may require that the Grantee modify or purge any acknowledgment of its support for activities conducted under this Grant as a result of its review of a final draft. If APHIS has not responded within 30 days of receipt of the draft, the Grantee will be free to proceed with publication without an acknowledgment. In the event that APHIS elects not to acknowledge the product, the Grantee agrees not to attribute sponsorship by APHIS by any means including, but not limited to, publications, interviews, new releases, etc.

When an acknowledgment is desired by APHIS, unless otherwise instructed by APHIS, the statement shall read: "This material was made possible, in part, by a Grant from the United States Department of Agriculture's Animal and Plant Health Inspection Service (APHIS). It may not necessarily express APHIS' views."

Additionally, any other acknowledgment, including use of the APHIS Logo, by the Grantee of APHIS support shall have the express written permission of APHIS signatory to this Agreement, which shall be requested through the APHIS representative designated under this Agreement.

ARTICLE 14 – BUY AMERICAN ACT

In the case of any equipment or product that may be authorized to be purchased with financial assistance provided using funds made available under the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act for the current Federal fiscal year, it is the sense of the Congress that entities receiving the assistance should, in expending the assistance, purchase only American-made equipment and products.

ARTICLE 15 – FUNDING PERIOD OBLIGATIONS AND EXTENSIONS

The funding period is the period during which this Agreement is in effect. Any funds not obligated by the Grantee during the funding period will revert to APHIS upon the expiration or termination of this funding period. Under 7 CFR 3019.25, this Agreement is subject to a one-time extension of up to 12 months to complete this project. The Cooperator must submit a written request including an SF-424, Application for Federal Assistance, to extend the duration to be received by APHIS **at least 10 days prior to the expiration of the funding period.** The SF-424 must be accompanied by a justification explaining the reason for program delays, the program impact without the extension, and the anticipated completion date. During the extension period, financial and progress reports will continue with the same frequency as provided in the original funding period. As stated in 7 CFR 3019.25, requests for extension purely to obligate funds will be denied by APHIS. All extensions must be approved, in writing, by APHIS prior to the expiration of the original funding period.

ARTICLE 16 – NON-DISCRIMINATION CLAUSE

No person in the United States shall be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination in programs or activities funded in whole or in part by the United States Department of Agriculture based on race, color, national origin, age, disability, and, where applicable, sex, religion or political

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beliefs. Recipients will post a non-discrimination statement in accordance with USDA Departmental Regulation 4300-003 paragraph 7.b(2) found at http://www.ocio.usda.gov/directives/doc/DR4300-003.pdf .

ARTICLE 17 – TRAFFICKING IN PERSONS

APHIS, as the Federal awarding agency, hereby advises the Cooperator, as the recipient, that they are subject to the provisions of the Trafficking Victims Protection Act of 2000 (TVPA), as amended (22 USC 7104(g), as follows:

a. Provisions applicable to a recipient that is a private entity.

(1) You, as the recipient, your employees, subrecipients under this award, and subrecipients' employees may not -

(a) Engage in severe forms of trafficking in persons during the period of time that the award is in effect;

(b) Procure a commercial sex act during the period of time that the award is in effect; or

(c) Use forced labor in the performance of the award or subawards under the award.

(2)We as the Federal awarding agency may unilaterally terminate this award, without penalty, if you or a subrecipient that is a private entity -

(a) Is determined to have violated a prohibition in paragraph a.(1) of this award term; or

(b) Has an employee who is determined by the agency official authorized to terminate the award to have violated a prohibition in paragraph a.(1) of this award term through conduct that is either—

i. Associated with performance under this award; or

ii. Imputed to you or the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 CFR part 180, "OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement)," as implemented by our agency at 7 CFR 3017.

b. Provision applicable to a recipient other than a private entity. We as the Federal awarding agency may unilaterally terminate this award, without penalty, if a subrecipient that is a private entity -

(1) Is determined to have violated an applicable prohibition in paragraph a.(1) of this award term; or

(2) Has an employee who is determined by the agency official authorized to terminate the award to have violated an applicable prohibition in paragraph a.(1) of this award term through conduct that is either -

(a) Associated with performance under this award; or

(b) Imputed to the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 CFR part 180, "OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement),' as implemented by our agency at 7 CFR 3017.

c. Provisions applicable to any recipient.

(1) You must inform us immediately of any information you receive from any source alleging a violation of a prohibition in paragraph a.(1) of the award term.

(2) Our right to terminate unilaterally that is described in paragraph a.(2) or b of this section:

(a) Implements section 106(g) of the Trafficking Victims Protection Act of 2000 (TVPA), as amended (22 USC 7104(g)), and

(b) Is in addition to all other remedies for noncompliance that are available to use under this award.

(3) You must include the requirements of paragraph a.(1) of this ward term in any subaward you make to a private entity.

d. Definitions. For purposes of this award term:

(1) "Employee" means either:

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(a) An individual employed by you or a subrecipient who is engaged in the performance of the project or program under this award; or

(b) Another person engaged in the performance of the project or program under this award and not compensated by you including, but not limited to, a volunteer or individual whose services are contributed by a third party as an in-kind contribution toward cost sharing or matching requirements.

(2) "Forced labor" means labor obtained by any of the following methods: the recruitment, harboring, transportation, provision, or obtaining of a person for labor or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage, or slavery.

(3)"Private entity":

(a) Means any entity other than a State, local government, Indian tribe, or foreign public entity, as those terms are defined in 2 CFR 175.25.

(b) Includes:

i. A nonprofit organization, including any nonprofit institution of higher education, hospital, or tribal organization other than one included in the definition of Indian tribe at 2 CFR 175.25(b).

ii. A for–profit organization.

(4) "Severe forms of trafficking in persons," "commercial sex act," and "coercion" have the meanings given at section 103 of the TVPA, as amended (22 USC 7102).

ARTICLE 18 – FLY AMERICAN ACT

The Cooperator organization shall comply with section 5 of the International Air Transportation Fair Competitive Practices Act of 1974, 49 U.S.C. 1517 (Fly American Act), which requires:

a. Any air transportation to, from, between, or within a country, other than the U.S., of persons or property, the expense of which will be assisted by USDA funding, will be performed on a United States flag carrier if service provided by such carrier is "available."

b. For the purposes of the requirement:

(1) Passenger or freight service by a certified air carrier is considered "available" even though:

(a) Comparable or a different kind of service by a noncertificated air carrier costs less; or

(b) Service by a noncertificated air carrier can be paid for in excess foreign currency; or

(c) Service by a noncertificated air carrier is preferred by the recipient organization contractor or traveler needing air transportation.

(2) Passenger service by a certificated air carrier is considered to be "unavailable":

(a) When the traveler, while enroute, has to wait 6 hours or more for an available United States carrier: or

(b) When any flight by a U.S. carrier interrupted by a stop anticipated to be 6 hours or more for refueling, reloading, repairs, and so forth, and no other flight by a United States carrier is available during the 6 hour period: or

(c) When the flight by a United States carrier takes 12 or more hours longer than a foreign carrier.

ARTICLE 19 – FUNDING/EFFECTIVE PERIOD, REVISIONS, AND TERMINATION

The Federal award for this Agreement is in the amount of $170,595 and the Cooperator's share is $0 for a total project cost of $170,595. These contributions establish a cost share ratio which shall be attained for the funding

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period except to the extent that there are cost overruns. Cost overruns will be the sole responsibility of the Cooperator, unless additional funding is secured from APHIS prior to the expiration of the funding period. In the event that project costs are less than projected, each party will realize a percentage of the savings to be distributed based on the established ratio. This Agreement shall become effective February 1, 2009, and shall continue through January 31, 2010, subject to continuation in writing by mutual agreement of the parties. Further, this Agreement may be amended at any time during the effective period by mutual agreement of the parties in writing. It may be terminated following provisions of 7 CFR 3019.

UNIVERSITY OF DELAWARE
5 U.S.C. § 552 (b) (6)

Date

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL CARE

4-2-09

Deputy Administrator for CAG Date

Budget Object Class: 4117
Accounting Code: 967 6101 A12
Amount: $170,595

UD

Scientific Evaluation on Factors of Foam Depopulation

Cooperative Agreement

Principal Investigators:

University of Delaware

5 U.S.C. § 552 (b) (6)

5 U.S.C. § 552 (b) (6)

Department of Animal and Food Science
5 U.S.C. § 552 (b) (6)

Start Date:

January 31, 2009

End Date:

February 28, 2010

Budget:

$170,595

Justification

The possibility of a highly pathogenic avian disease outbreak is an ongoing concern for the poultry industry. Control of poultry diseases requires surveillance, rapid detection, confinement, depopulation, disposal, and disinfection. Quarantine of the area is an immediate step in control of an infectious poultry disease and can significantly reduce the spread of the disease. Birds that are infected or suspected of infection are depopulated or culled using the most expedient and humane methods available. Depending on the nature of the disease outbreak, vaccination can be an essential part of the response plan. Vaccination can increase resistance to field virus challenge, reduce shedding levels in vaccinated birds and improve transmission dynamics. Vaccination and depopulation can be used together as control measures for avian influenza. Recent events in Hong Kong have raised additional concerns that vaccination may not be an appropriate control measure for Avian Influenza virus.

Depopulation of infected birds must balance human health, animal health and other risk factors. The American Veterinary Medical Association (AVMA) describes euthanasia as "rapid loss of consciousness followed by cardiac or respiratory arrest and the ultimate loss of brain function" (AVMA, 2007). During mass emergencies such as a disease outbreak, there are fewer options. The 2007 AVMA Guidelines on Euthanasia devotes only one paragraph on mass euthanasia which states "Under unusual conditions, such as disease eradication and natural disasters, euthanasia options may be limited. In these situations, the most appropriate technique that minimizes human and animal health concerns must be used."

Gassing is one of the accepted methods for euthanizing poultry. Gassing methods have been studied under laboratory conditions and used to develop field depopulation methods (Poole and Fletcher, 1998; Lambooij et al., 1999; Gerritzen et al., 2000; Raj et al., 2006). Carbon dioxide (CO_2), argon (Ar), nitrogen (N_2) and mixtures of the individual gases are most commonly employed. Argon and N_2 displace oxygen (O_2) in the air, while CO_2 directly affects the central nervous system as well as displace oxygen. Carbon dioxide has an anesthetic effect, but at the concentrations required to kill poultry can cause irritation and pain to the mucosa (Raj et al., 2006). Argon and other inert gases may cause less aversion than CO_2 alone (Raj et al., 2006; Niel and Weary, 2007). Carbon dioxide gassing is one of the most widely used procedures for large-scale emergency depopulation of meat-type birds. For CO_2 gassing, two basic approaches include whole or partial- house gassing and containerized gas euthanasia systems (Raj, 2008).

The problems with the existing depopulation techniques lead to the development of water based foam depopulation procedures. The use of water based foam was found to be faster than current depopulation techniques (Benson, et al., 2007; Dawson, et al., 2006). Corticosterone analysis indicates that the stress experienced by the birds depopulated with foam was equal or less than the stress experienced during CO_2-polyethylene tent treatment (Benson, et al., 2007).

The initial research at the University of Delaware documented that the foam procedure was effective for broilers. Research conducted in conjunction with the North Carolina Department of Agriculture documented the effectiveness of foam with turkeys (Howard, 2007); however, scientific measures of cessation were not collected. Because of the commercial importance of broilers, additional foam depopulation research should be conducted. Additional research has shown that water based foam can be used for mass emergency depopulation of broilers, call and Pekin ducks, Japanese quail, and chukars (Benson, et al., 2009).

Initial research at the University of Delaware showed that CO_2 gas infused foam was no more or no less effective than foam without gas. Additional research collected in 2007 – 2008, showed that the differences between water based foam with and without CO_2 gas were both practically and statistically insignificant; indicating that the addition of CO_2 gas to water based foam is unlikely to have a material impact on mass emergency depopulation of poultry. Foam without gas was more consistent than Ar-CO_2 or CO_2 gassing. Additional data with broilers and/or leghorns should be collected to complete the data set. Water based foam performs no worse than the gassing procedures and often better than the available gassing procedures.

Water based foam requires large quantities of water and water will be procured in the most expedient method possible. Water based foam depopulation has been used within the United States as part of an emergency response to avian influenza and in at least one situation, water quality was suspected of causing problems. Both an evaluation of the impact of water quality on foam depopulation and a means to measure foam quality are urgently needed.

Objectives

Objective A. Evaluate the use of water based foam with and without inert gas for depopulation of broilers and leghorns

Objective B. Evaluate the use of water based foam with and without inert gas for depopulation of turkeys.

Objective C. Develop a valid foam field testing strategy

Objective D. Evaluate the impact of variable water conditions on foam generation

Objective E. Maintain and update and educational module on foam depopulation

Project Narrative

Objective A

Evaluate the use of water based foam with and without inert gas for depopulation of broilers and leghorns

Justification

During 2006 – 2008, the University of Delaware research group began to document the response of broilers during depopulation. Broilers were instrumented with wireless EEG, wired ECG, and motion sensors and treated with CO_2, Ar-CO_2, water based foam, or water based foam with CO_2 gas. A suitable number of valid replications with all three sensors were collected for CO_2, Ar-CO_2 and water based foam. A limited number of observations with all three sensors were collected with water based CO_2 gas. To increase the statistical power of the results, additional data should be collected with water based foam with CO_2 gas using the same experimental system. Increasing the statistical power will improve response during peer review.

In addition, research on caged layers is underway at the University of Delaware and other institutions. During large scale studies, it is not practical to intensively monitor birds during depopulation with EEG, ECG and motion cessation sensors. For this reason, depopulation data for caged leghorns during water based foam depopulation should be collected.

Procedure

In Objective A, currently available water based foam equipment will be used to evaluate water based foam with CO_2 for broilers and leghorns. The water based foam depopulation equipment may include, but not be limited to Kifco AviGuard, Spumifer AG-1, Amerex Model 250, and a modified Ansul Mini-Fomax. In particular, the Ansul Mini-Fomax and Amerex Model 250 generator will be used to test depopulation inert-gas infused foam.

The equipment will be evaluated on the ability of the equipment to depopulate birds and the impact on welfare. Carbon dioxide will be used as the reference depopulation method. If the standard equipment does not prove suitable, the equipment may be modified to improve foam characteristics.

To evaluate the impact of foam with and without inert gas on depopulation, EEG, ECG, and accelerometer equipment will be used to simultaneously monitor brain and heart activity. A wireless telemetry system (DataScience International) will be used to monitor brain activity (EEG). An existing tethered telemetry system (BIOPAC Systems, Inc. Student Laboratory edition or equivalent) will be used to monitor heart activity. An acceleration sensor will be used to monitor leg and gross body movement.

The foam depopulation technology may be chosen from the Kifco style foam generator system, Ansul Mini-Fomax foam generator, medium expansion foam generator and/or reduced scale systems appropriate for laboratory use. Dye may be added to the foam to improve visualization of the movement of the foam within the bird. Treatment will occur within a 50 gallon (189 liter) polycarbonate chamber or similar. Wireless telemetry receivers will be located in the treatment chamber.

Prior to the experiment, testing may be conducted to determine the release time of gases from foam. The Amerex Model 250 will be charged with CO_2 or O_2 and used to produce high concentration gas. Oxygen rather than CO_2 may be used because of the ease of getting appropriate sensors for high gas concentrations. An appropriate sensor will be located inside a gas tight chamber and foam will be released into the chamber through a check valve. The time rate of increase in the gas concentration will be monitored through the sensor. The results from this will be compared to pre-existing data on cessation time of birds in foam.

Gas flow rates and flow times will be recorded. Bird activity will be monitored using a PCB Piezioelectric accelerometer 352C66 or similar attached to the right leg. Carbon dioxide levels will be recorded at 60 s using GasTec 0 – 100% CO_2 dosimeter tubes or alternative gas monitoring equipment. Oxygen sensors (OxyCheq or equivalent) may be located inside the chamber to determine O_2 level. Temperature sensors may be located within the chamber as well. Electronic sensors will be recorded using National Instruments LabVIEW software.

Data Sciences International (DSI) 3-channel PhysioTel Model F50-EEE wireless transmitters will be surgically implanted in the back of the neck of each bird. The implant will be sterilized using a cold chemical sterilization liquid prior to the procedure. Birds will be provided with 5% isoflurane at induction with 2% isoflurane for maintenance of general anesthesia during surgery and allowed to recover for 24 to 48 hours prior to heat stress. Biopotential leads for EEG will be implanted with the brain through 0.9 mm holes drilled into the skull just below the comb using a Fine Science Tools (Foster City, CA) Model 18000-17 high-speed micro drill. The leads will be cut to an appropriate length, their exposed ends bent through 90 degrees and inserted in the holes and anchored in position using dental acrylic with the tips of the sensing electrodes touching the telencephalon. Additional leads for EMG will be implanted in the neck muscles near the surgery site. The surgical procedure is based on Savory and Kostal (2006) and Savory and Kostal (1997). While the bird is under general anesthesia, ECG electrode locations will also be prepared. After recovery, the bird will be placed on heating pads and monitored. Birds will be allowed to recover for 24 to 48 hours before depopulation.

Two DSI RMC-1 PhysioTel receivers will be placed opposite one another at the bottom of the exhibition cage. Brain activity will be monitored and recorded using DSI Dataquest A.R.T. Acquisition software. Raw EEG data will be exported into text files through the Dataquest A.R.T. Analysis software to allow for analysis in Microsoft Excel. EEG files will be analyzed in DSI NeuroScore software to detect EEG silence.

On the day of treatment, ECG pads will be affixed to the bird in the prepared locations. The birds will be placed in a polycarbonate chamber equipped with Data Sciences International RPC-1 antenna or equivalent. Output from the EEG and ECG sensors will be checked prior to beginning treatment. Treatments will be randomized to avoid testing effects. Multiple video cameras will be located to record the activity of the bird. Prior to treatment, EEG and ECG baseline data recording will begin.

A total of 12 valid three sensor trials are required to ensure appropriate statistical power. A total of 8 valid trials with broilers treated with water based foam with CO_2 were collected in 2007 – 2008. In 2009 – 2010, additional data sets would be collected from single combed white leghorn treated with water based foam and water based foam with CO_2 gas. A minimum of 24 trials will be required for single combed

white leghorns. When practical, birds will be obtained from other experiments at the University of Delaware (broilers) or from spent layer hens (single combed white leghorns).

Objective B

Evaluate the use of water based foam with and without inert gas for depopulation of turkeys and/or other species.

Justification

In 2007 and 2008, AI positive birds were detected in turkeys and mixed game birds, resulting in culling of the flocks. The size and height of turkeys introduces particular challenges in terms of creating an appropriate quantity of foam. Turkeys, unlike floor reared broilers, can be herded into an area. One question is whether the turkeys could be herded into an area and then allowed to drop into foam, reducing the amount of personal contact required.

Procedure

This objective is a two stage objective. In the first stage, turkeys will be depopulated using an foam immersion method; in the second stage, turkeys will be evaluated using a foam coverage method.

In the first stage, turkeys will be instrumented with wireless EEG, wired ECG, and motion sensors as described in Objective A. Turkeys will be grown to a height of 36" to 48" prior to conducting the experiment. The birds will be depopulated individually by immersing them in foam created using a Spumifer AG-1 nozzle, Ansul Mini-Fomax, or Kifco AviGuard or similar. The selection of foam depopulation equipment will allow evaluation of both medium expansion and high expansion foam systems. In the first stage, foam sufficiently high enough for turkeys will be created in a chamber and the birds immersed in the foam. This represents a different approach to foam depopulation. Depending on the early results of this experiment, the experiment may be repeated with water based foam with CO_2 gas.

A total of 12 valid three sensor trials are required to ensure appropriate statistical power. A minimum of 30 trials will be required for single combed.

In the second stage, the ability of two types of foam generation equipment to depopulate small numbers of floor reared turkeys will be evaluated. The birds will be located on the floor of the test chamber prior to the experiment and foam will be built up around the birds. The Spumifer AG-1 nozzle will serve as one treatment and a high expansion foam generator (Ansul Mini-Fomax or Kifco AviGuard) will serve as the second treatment. The maximum height of the foam will be measured versus bird height prior to conducting the experiment. One bird per replication will be instrumented with wired ECG and motion cessation sensors. Up to three replications of ten turkeys will be mass depopulated with each type of foam generation equipment.

Objective C

Develop a valid foam field testing strategy

Justification

During mass emergency depopulation, equipment and personnel will be rapidly acquired to complete the process. A number of factors can influence the quality of foam produced. In many cases, the equipment will not have been tested or have been tested recently and the resulting foam may or may not be suitable for depopulation. Foam should be tested prior to depopulation to ensure that the foam has the proper characteristics prior to mass emergency depopulation. If changes to the system are required, the changes should be made prior to beginning the depopulation process.

Because no method exists for testing the quality of the foam, a small test apparatus was created to see if there were differences in foam quality. In this apparatus, a large volume syringe was equipped with a Magnahelic vacuum sensor and the syringe was used to draw foam through an inlet tube. Differences in vacuum and the distance the foam was drawn were observed. This system needs to be improved and additional testing with other foam generation strategies investigated.

Procedure

Small quantities of foam will be prepared using available water based foam depopulation equipment. The current approach will be tested with multiple varieties of foam.

A 60 cc syringe will be connected to a Magnehelic pressure gage via a t-section, with a vinyl hose directed into the foam. The syringe will be slowly retracted at a steady speed until the foam is drawn to the proper location in the tube and the pressure recorded. The system will be tested with multiple foam concentrates, desired draw locations, and tube diameters.

Depending on the success of this strategy, an additional strategy may be investigated. In this approach, foam will be directed into a large bore funnel. The ability of the foam to flow through the funnel will be monitored.

Objective D

Evaluate the impact of variable water conditions on foam generation

Justification

Fire fighting foam is designed to be used with a variety of water sources. Vendors report that the foam can be used with brackish water, salt water, hard water, and similar. What often is not reported is the impact of water quality on foam quality or foam production. During mass depopulation, water will come from the most expedient source possible and the quality of the water will be variable.

Procedure

For this procedure, two types of foam generation equipment will be evaluated, a nozzle type system and a foam generator system.

The recommended foam concentrate for each system will be held constant through the experiment, although additives may be included in the foam concentrate to improve performance. Experiments will be repeated with municipal water, hard water, brackish water, and salt water. For hard, brackish and salt water, up to 2 commercially available additives may be tested. The foam generation equipment will be flushed and cleaned between experiments.

The foam will be evaluated based on maximum foam height, bubble size, impact on foam generation, and suitability for depopulation.

Five combinations of test conditions (water type x generation system x additive) representing a range of foam quality will be tested for depopulation performance. Depopulation performance will be evaluated

using adult spent layers, broilers, turkeys, ducks, pheasants, or other game species, based on availability. Up to three replications of each test condition will be used to depopulate three adult birds. Birds will be instrumented with wireless EEG, wired ECG, and/or motion sensors as described in Objective A. All five combinations of test conditions will be evaluated on the same species.

Water samples will be collected and analyzed for total suspended solids, pH, and salinity at the University of Delaware Water Quality Laboratory.

Development and selection of foam additives will be conducted through consultation with other USDA funded foam research groups (Texas A&M).

Experiments: 4 water types x 2 foam generation systems x 3 test conditions (no additive, additive A, additive B) x 3 replications = 72 tests

Water samples: 4 water types x 3 replications

Objective E

Maintain and update an educational module on foam depopulation

Justification

The technology for foam depopulation has been demonstrated to a variety of audiences. As part of this project, a significant amount of new information has been developed. It is not practical to bring the information to all audiences. For this reason, the information should be made available to the audience.

Procedure

An online, password protected module on foam depopulation will be developed. The module would include audio and visual media and would be made available through a password protected portion of the UD Avian Bioscience Center. The module would be developed for the contractor audience. The module would be based on the materials prepared in 2007 – 2008, with updates for alternate species, water based foam, or water based foam with CO_2 gas, and use of foam for caged layers.

Project Management:

5 U.S.C. § 552 (b) (6) will serve as the project director for the project. 5 U.S.C. § 552 (b) (6) engineering modifications to the equipment and/or sensors and development of the educational materials.

5 U.S.C. § 552 (b) (6) will manage bird health and coordinate EEG surgery.

Budget justification
The total requested budget is $170,595.

Salaries and Wages

Funds are requested to support 5 U.S.C. § 552 (b) (6) with a 9 month appointment, 5 U.S.C. § 552 (b) (6) 5 U.S.C. § 552 (b) (6) faculty member with a 9 + 2 month appointment, for one month of summer salary.

5 U.S.C. § 552 (b) (6)

will commit 1% effort to meet the minimum matching requirement. Their actual commitment to the project may be higher.

Support for undergraduate research students ($7,000), a masters degree graduate student ($22,000,
5 U.S.C. § 552 (b) (6) and technician (4.0 months, $20,000) to support the listed experiments is requested.

Fringe Benefits

University of Delaware Fringe benefit rates are 34% for faculty, staff and technicians, 4% for graduate students, and 8% for undergraduate students.

Travel

Travel funds ($9,250) are requested for three scientific presentations (two domestic, one international) and for local travel to and from test site and/or meeting with USDA representatives. 5 U.S.C. § 552 (b) (6) present at the 2009 European Symposium on Poultry Welfare in Cervia, Italy with costs estimated at $4,500 for airfare ($2,000), lodging ($200/night x 5 nights), and other fees. 5 U.S.C. § 552 (b) (6) 2009 AVMA / AAAP meeting in Seattle, WA with costs estimated at $2,000 for airfare ($400), lodging ($200/night x 5 nights), and other fees. 5 U.S.C. § 552 (b) (6) at the International Symposium on Avian Influenza in Athens, GA with costs estimated at $1,500 for airfare, lodging, and other fees.

Equipment

No additional equipment is requested.

Materials and Supplies

The three existing computers used for wireless EEG, wired ECG, and motion cessation are in need of refurbishment or replacement. The accelerometer and ECG computers can use PCMCIA or USB devices will be replaced with Dell Latitude ATG laptops or equivalent (2 x $2,350). The EEG computer requires PCI configuration and will be replaced with a Dell Inspiron desktop computer or equivalent ($1,300).

Objective A (Evaluate the use of water based foam with and without inert gas for depopulation of broilers and leghorns) will require foam concentrate, modifications to foam equipment, raising, transporting and/or securing birds, and other consumables ($10,000). Foam concentrate is estimated at $1050 (10 x 5 gallon containers of concentrate at $85/ea, $200 shipping). An estimated 2 days of surgery and depopulation experiment days will be required for broilers ($200 consumables / day = $400). An estimated 7 days of surgery and depopulation experiment days will be required for leghorns ($200 consumables / day x = $1,400). Modifications and / or service to the foam generators will be required ($2,000). Although birds will primarily be secured from other projects, birds will need to be maintained prior to surgery ($0.30/per bird per day, 50 birds, 30 days, $525). One additional EEG receiver transmitter ($2,630) is requested. In addition, the four current EEG transmitters require annual refurbishment and battery recharge ($400 each). In addition, Objective A will require additional consumables ($395).

Objective B (Evaluate the use of water based foam with and without inert gas for depopulation of turkeys) will use the same basic equipment as Objective A ($15,000). The experiment will be conducted in two phases, with foam required for both phases. Foam concentrate is estimated at $1,190 (14 x 5 gallon containers of concentrate at $85/ea, $200 shipping). Birds will be raised for up to 22 weeks ($0.30/per bird per day, additional feed cost, 50 birds x 25 weeks, $5,392). An estimated 10 days of surgery and depopulation experiment days will be required for leghorns ($200 consumables / day x = $2,000). In

addition, Objective B will require additional consumables ($4,240). Objective B has a higher consumable cost than Objective A because our research group has not worked with turkey depopulation.

Objective C (Develop a valid foam field testing strategy) may require additional sensors and field testing ($1,250). Foam concentrate will largely come from Objectives A and B. The expected costs for this include additional pressure sensors (Magnahelic or similar, $100), machine vision validation, and consumables ($1,050).

Objective D (Evaluate the impact of variable water conditions on foam generation) will require extensive field testing, transportation to obtain appropriate brackish, salt and hard water, multiple foam concentrates and additives ($7,000). To reduce travel, four 500 gallon storage tanks will be used to reduce travel and maintain a consistent water source (4 x $550). Samples would be analyzed at the University of Delaware Water Quality Laboratory or outsourced (72 samples x $25/sample). Foam concentrate is estimated at $1050 (10 x 5 gallon containers of concentrate at $85/ea, $200 shipping). In addition, Objective B will require additional consumables ($1,950). In addition, birds may be raised or procured for testing.

Objective E (Maintain and update an educational module on foam depopulation) to maintain and update appropriate web resources ($5,000). The most significant cost is image preparation to reduce the sensitive nature of the images (25 images x $35/hr x 3 hours, outsourced).

Other Costs

Support for publication and dissemination of results in one scientific journal (Poultry Science, Journal of Applied Poultry Research or equivalent) ($1,000).

In addition, up to $5,000 is requested to work with a collaborator on evaluation of the EEG signals.

Indirect Costs

The federally negotiated indirect cost rate for a research proposal in the College of Agriculture and Natural Resources is 29.2%. Since APHIS limits the indirect costs we can charge to 20%, the difference of 9.2% is listed as match.

References

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Dawson, M. D, P. L. Reyes, E. R. Benson, R. L. Alphin, G. W. Malone, G. L. Van Wicklen, and I. Estevez. 2006. Evaluation of foam based humane mass euthanasia methodology for floor-reared meat-type poultry operations. Appl. Eng. Agric. 22(5):787-794.

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	Overall Budget				
		Year 1			
A. Personnel	Person (time period)				
PI and Co-PI	(b)(6)	$ 9,444.44		1 month summer salary	
		$ 7,876.44		1 month summer salary	
Research Assistant		$20,000.00		(b)(6)	
Grad Students		$22,000.00			
Post doc with fringe		$ -			
Post doc without fringe		$ -			
Students (summer)		$ 7,000			
Students (semester)		$ -			
Secretary Support		$ -			
Total Personnel		$ 66,321			
B. Fringe Benefits	Rate				
PI and Co-PI	34.0%	$ 5,889			
Research Assistant	34.0%	$ 6,800			
Grad students	4.0%	$ 880			
Post Doc with Benefits	34.0%	$ -			
Post Doc without benefits	0.0%	$ -			
Students (summer)	8.0%	$ 560			
Students (semester)	8.0%	$ -			
Secretary support	43.5%	$ -			
Total Fringe Benefits		$ 14,129			
Total Salary and Fringe		$ 80,450			
C. Travel	Purpose	$ -			
	Data collection	$ 1,250		Mainly Objective A (obtain feghorns) and Objective D (water quality)	
	AVMA / AAAP Seattle WA	$ 2,000		Report on prev year and Objective A, may include Objective B if significant results are complete	
	Bird Welfare - Cervia, IT	$ 4,500		Report on prev year and Objective A	
	International AI Symposium	$ 1,500		Report on prev year and Objective A	
Total Travel		$ 9,250			
D. Equipment					
$5,000 or more (no indirect costs)		$ -			
Total Equipment					
E. Supply					
				Evaluate the use of water based foam with and without inert gas for depopulation	
Objective A		$ 10,000.00		Objective A. of broilers and leghorns	
			$ 1,050.00	Foam concentrate	
			$ 525.00	Bird costs	
			$ 2,000.00	modifications	What's this cha
			$ 1,800.00	Surgery and experiment days	We currenti
			$ 2,630.00	EEG transmitter	foam inside
			$ 1,600.00	Refurbishment	multiple reg
			$ 395.00	Misc consumables	working wit
				Evaluate the use of water based foam with and without inert gas for depopulation	
Objective B		$ 15,000.00		Objective B. of turkeys.	
			$ 1,300.00	Foam concentrate	
			$ 5,392.50	Bird costs	
			$ 2,000.00	Surgery and experiment days	
			$ 2,000.00	modifications	What's this cha
			$ 4,240.00	Misc consumables	For turkeys,
Objective C		$ 1,250.00		Objective C. Develop a valid foam field testing strategy	the two stag
			$ 200.00	Sensors	pressure. In
			$ 4,240.00	Misc consumables	pump.
				Evaluate the impact of variable water	
Objective D		$ 7,000.00		Objective D. conditions on foam generation	
			$ 2,200.00	Storage tanks	
			$ 1,800.00	Water samples	
			$ 1,050.00	Foam concentrate	
			$ 1,950.00	Misc consumables	
				Maintain and update and educational	
Objective E		$ 5,000.00		Objective E. module on foam depopulation	
			$ 250.00	Spring Professional	The two Beans F
			$ 1,875.00	images	Website dev
Instrumentation		$ 6,000.00		Replacement computers	Nature Reso
			$ 2,350.00	Dell Latitude ATG laptop (ECG)	
			$ 2,350.00	Dell Latitude ATG laptop (ACC)	
			$ 1,300.00	Dell Inspiron desktop (ECG)	
Misc		$ 2,212.50			
Total Supply		$ 46,463	$ -		
F. Contracts		$ -		To be added later: Southwest Research Institute (SWRI) - foam additives	
	1st 25,000				
	over 25,000 (no indirect costs)	$ -			
Total Contracts		$ -			
G. Other	Item				
		$ 1,000		Poultry Science and/or Journal of Applied Poultry Research	
	Refereed publication				
	EEG Collaboration	$ 5,000		Would a contract be awarded for this activity? If so, move to Cont	
Total Other		$ 6,000		We would hire out on an hourly basis for EEG collaboration.	
	Totals				
H. Total Direct costs		$ 142,162			
Modified Direct costs		$ 142,162			
I. Indirect costs	20.0%	$ 28,432			
J. Total Project cost	H+I	$ 170,595			
K. Total request		$ 170,595			

III

08-6100-0032-GR

REVISION NO. 08-2
TO THE
NOTICE OF GRANT AWARD
BETWEEN THE
UNIVERSITY OF DELAWARE (COOPERATOR)
AND THE
UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL CARE (APHIS)

Under the provisions of Article 17, the Cooperator and APHIS hereby mutually agree to revise terms and conditions of the Fiscal Year 2008 Notice of Grant Award 08-6100-0032-GR to develop and evaluate technologies for water based foam depopulation of meat type birds and caged layers, evaluate the impact of time and the onset of rigor mortis on removal of birds from cages, measure and compare the bird stress due to foaming in cage, removal from cage with transport to depopulation, and removal from cage and immediate gassing, and maintain and update the education module on foam depopulation.

The following Article is revised to allow a one-time extension to the Grant.

ARTICLE 17

The Federal award for this Grant is in the amount of $131,489. Cost overruns will be the sole responsibility of the Grantee, unless additional funding is secured from APHIS prior to the expiration of the funding period. This Grant became effective October 25, 2007, and shall continue through January 31, 2009, subject to continuation in writing by mutual agreement of the parties. Further, this Grant may be amended at any time during the effective period by mutual agreement of the parties in writing. It may be terminated following provisions of 7 CFR 3019.

It is further understood by and between the parties that in all other respects, the original terms, conditions and provisions of said Agreement shall remain in full force and effect.

UNIVERSITY OF DELAWARE

5 U.S.C. § 552 (b) (6)

10/24/08
Date

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL CARE

for Deputy Administrator

10-3
Date

Budget Object Class: 4117
Accounting Code: 867 6101 A12
Amount: $131,489

08-6100-0032-GR

REVISION NO. 08-1
TO THE
NOTICE OF GRANT AWARD
BETWEEN THE
UNIVERSITY OF DELAWARE (COOPERATOR)
AND THE
UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL CARE (APHIS)

Under the provisions of Article 17, the Grantee and APHIS hereby mutually agree to revise terms and conditions of the Fiscal Year 2008 Notice of Grant Award 08-6100-0032-GR to provide Federal financial assistance to develop and evaluate technologies for water based foam depopulation of meat type birds and caged layers, evaluate the impact of time and the onset of rigor mortis on removal of birds from cages, measure and compare the bird stress due to foaming in cage, removal from cage with transport to depopulation, and removal from cage and immediate gassing, and maintain and update the education module on foam depopulation.

The following Article is revised to change the effective period of the Grant.

ARTICLE 17

The Federal award for this Grant is in the amount of $131,489. Cost overruns will be the sole responsibility of the Grantee, unless additional funding is secured from APHIS prior to the expiration of the funding period. This Grant became effective October 25, 2007, and shall continue through October 24, 2008, subject to continuation in writing by mutual agreement of the parties. Further, this Grant may be amended at any time during the effective period by mutual agreement of the parties in writing. It may be terminated following provisions of 7 CFR 3019.

It is further understood by and between the parties that in all other respects, the original terms, conditions and provisions of said Agreement shall remain in full force and effect.

UNIVERSITY OF DELAWARE

5 U.S.C. § 552 (b) (6)

4/11/2008
Date

Ellen M. Pletz
Contract & Grant Admin.

Budget Object Class: 4117
Accounting Code: 867 6101 A12
Amount: $131,489

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL CARE

Barbara Kahl 4/24/08
Deputy Administrator (acting) Date
for
Chester Gipson

ENTERED

NOTICE OF **GRANT** AWARD
BETWEEN THE
UNIVERSITY OF DELAWARE (COOPERATOR)
AND THE
UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS)
ANIMAL CARE

ARTICLE 1 - PURPOSE

The purpose of this **Grant** is to provide Federal financial assistance to develop and evaluate technologies for water based foam depopulation of meat type birds and caged layers, evaluate the impact of time and the onset of rigor mortis on removal of birds from cages, measure and compare the bird stress due to foaming in cage, removal from cage with transport to depopulation, and removal from cage and immediate gassing, and maintain and update the education module on foam depopulation.

ARTICLE 2 - AUTHORITIES

Under the Farm Security and Rural Investment Act of 2002, PL 107-171, Subtitle E, Animal Health Protection, Section 10401-10418, the Secretary of Agriculture, in order to protect the agriculture, environment, economy, and health and welfare of the people of the United States by preventing, detecting, controlling, and eradicating diseases and pests of animals, is authorized to cooperate with foreign countries, States, and other jurisdictions, or other persons, to prevent and eliminate burdens on interstate commerce and foreign commerce, and to regulate effectively interstate commerce and foreign commerce.

ARTICLE 3 – MUTUAL UNDERSTANDINGS AND RESPONSIBILITIES

The cooperating parties agree to/that:

a. A mutually satisfactory annual **Work Plan** and **Financial Plan** developed by the **Grantee** and APHIS are incorporated into this **Grant** by reference.

b. The provisions of this **Grant** will not replace functions that are being conducted by the **Grantee** but will supplement those activities and increase program benefits to all parties.

c. The employee(s) responsible for this work will be under the general program direction of the **Grantee and APHIS**. Supervision of personnel will be provided by their employing organization, and they will be subject to their employing organizations rules and regulations.

ARTICLE 4 – **GRANTEE** RESPONSIBILITIES

The **Grantee** agrees to/that:

a. Designate5 U.S.C. § 552 (b) (6) authorized representative who shall be responsible for collaboratively administering the activities conducted under this **Grant.**

b. Furnish personnel, as required, to accomplish the activities outlined in the **Work Plan and Financial Plan.**

c. Provide funds as partial payment of expenditures incurred in carrying out the terms of this **Grant** in accordance with the **Work Plan and Financial Plan.**

d. Submit to APHIS' authorized representative **quarterly** accomplishment reports on program activities outlined in the **Work Plan and Financial Plan.** The reports will be used by APHIS to verify compliance with provisions of this **Agreement.** These reports are due **no later than 30 days** after the end of each quarter except the final report which is due **no later than 90 days** after the **Grant** expires or terminates. Any requests for an extension of time to submit the report must be made in writing to APHIS' authorized representative before expiration of the initial 30 or 90 day period allowed for submitting the report. Extensions of time to submit reports are subject to the discretion of APHIS' authorized representative and, if allowed, shall be provided by the authorized representative in writing.

e. Submit to APHIS' authorized representative a properly certified **quarterly** Financial Status Report, SF-269, **no later than 30 days** after the end of each quarter and a final SF-269 **no later than 90 days** after the **Agreement** expires or terminates. Any requests for an extension of time to submit the SF-269 must be made in writing to APHIS' authorized representative before expiration of the initial 30 or 90 day period allowed for submitting the report. Extensions of time to submit the SF-269 are subject to the discretion of APHIS' authorized representative and, if allowed, shall be provided by the authorized representative in writing.

f. Treat any program income derived under this **Grant** using the Deduction Alternative in accordance with the provisions of 7 CFR 3019.24(b)(3) which provides for a decrease in the financial contributions of each cooperating party to this project.

g. Submit to APHIS a properly certified Request for Advance or Reimbursement, SF-270, when requesting payment for expenditures. A payment request may be submitted quarterly or more frequently; however, advance of funds will be made by APHIS in increments as indicated under 11.j of the SF-270 to cover monthly disbursement needs.

h. Obtain a Dun and Bradstreet (D&B) Data Universal Numbering System (DUNS) number by calling D&B at (800) 333-0505 (most expeditious) or visiting their website at http://www.dnb.com/us. This requirement does not apply to individuals applying for assistance, unless it supports a business or non-profit organization they operate. Upon obtaining the DUNS number, the **Grantee** further agrees to register in the Central Contractor Registry (CCR) by visiting their website at http://www.ccr.gov (most expeditious) or calling 888-227-2423. The **Grantee** also agrees to update the CCR information as necessary and to **renew the registration annually prior to its expiration date.** This registration will provide a means to receive electronic funds transfers of all payments requested on the SF-270. **Grantees** without accounts at financial institutions can request waivers due to hardship because of physical or geographical barrier.

i. Electronic payments status information can be obtained by accessing the United States Treasury's Financial Management Service Payment Advice Internet Delivery (PAID) system, available at no-cost. Banking information is not available, and data is kept on-line for 60 days. To register, access the PAID web site at http://fms.treas.gov/paid. One of three payment options are available: (1) web access only, (2) web access and e-mail notification of when a payment has been made, and (3) web access and e-mail delivery of remittance information. Cooperators should contact their central finance office to determine whether registration has been accomplished for their entire agency or institution.

j. APHIS may withhold payments called for in Article 5.b under the conditions outlined in 7 CFR 3019.22(h).

k. Comply with 7 CFR 3017, Subpart C to ensure that any subrecipients that carry out the provisions of this **Grant** are not debarred or suspended. Subrecipients are required to disclose if they, or any of their principals, are presently excluded or disqualified.

l. Comply with and enforce the requirements for a drug-free workplace as mandated in 7 CFR 3021, "Governmentwide Requirements for Drug-Free Workplace".

m. Comply with and enforce the requirements in 7 CFR 3018.110 (d) (1) and (2) for completion of the Certification Regarding Lobbying and the SF-LLL, Disclosure of Lobbying Activities. Such certifications and disclosures apply to the Grantee and any subgrants and subcontracts exceeding $100,000.

n. Maintain an inventory control system of property purchased by the **Grantee** in whole or in part with Federal funds as required in the Section entitled "Equipment" of 7 CFR 3019.34. Cooperators shall conduct a physical inventory at least every two years and make available, as requested, the required records for review by APHIS. A copy of the reconciled final inventory report will be provided to APHIS as stated in Article 10 of this Agreement.

o. Provide an annual inventory report of any Federally-owned or Federally-leased equipment on loan to the Cooperator.

p. When the Federal share of total project costs as reflected in the **Financial Plan** is over $100,000 and a cumulative transfer among direct cost categories is in excess of ten percent of the current approved total budget, the **Grantee** will request written prior approval for the budget revision. The **Grantee** will submit a revised SF-424A, Budget Information, and detailed **Financial Plan** under a cover letter to the APHIS awarding official containing a narrative justification for the proposed revision. Transfers of funds among programs, functions, or activities as indicated in Section B of the SF-424A is prohibited.

q. Upon submission of the final SF-269, execute a formal revision for any decrease of $1,000 or more in the Federal funding level of the agreement as provided for in 2 CFR 215.71(e).

r. Meet the reporting requirements of the Federal Funding Accountability and Transparency Act by providing the following information. Parent organization DUNS number; primary place of performance street address, city, county, state, country and zip code; indicate if performance is in multiple counties and/or states; and provide any comments that might be relevant. APHIS will provide a supplemental sheet for the Grantee's convenience in recording this information.

s. As a condition of this grant, the recipient assures and certifies that it is in compliance with and will comply in the course of the agreement with all applicable laws, regulations, Executive Orders and other generally applicable requirements, including those set out in 7 CFR 3015.205(b), which hereby are incorporated in this agreement by reference, and such other statutory provisions as are specifically set forth herein.

ARTICLE 5 – APHIS RESPONSIBILITIES

APHIS agrees to/that:

a. Designate Dr. Darrel Styles, USDA, APHIS, AC, 4700 River Road, Unit 84, Riverdale, MD 20737, 301-734-0658 or 202-205-4802, as its Authorized Departmental Officer's Designated Representative who shall be responsible for collaboratively administering the activities conducted under this **Grant**.

b. Provide funds on an advance or reimbursable basis as payment of allowable, agreed-to costs incurred by the **Grantee** in carrying out the terms of this **Grant** in accordance with the **Work Plan and Financial Plan.**

c. Make advance payments, if requested by the **Grantee**, monthly and upon receipt of a properly certified Request for Advance or Reimbursement, SF270.

d. Provide personnel and other resources to carry out its responsibilities as outlined in the **Work Plan and Financial Plan**.

ARTICLE 6 – UNEMPLOYMENT COMPENSATION

Actual costs incurred for unemployment insurance or equitable contributions made to a self-insured unemployment fund are allowable. APHIS does not allow payment of costs incurred for unemployment claims.

ARTICLE 7 – CONGRESSIONAL RESTRICTION

Under 41 USC 22, no member of or delegate to Congress shall be admitted to any share or part of this **Grant** or to any benefit to arise therefrom.

ARTICLE 8 – APPLICABLE REGULATIONS

As a condition of this award, the **Grantee** agrees to comply and require subrecipients to comply with the requirements contained in the United States Department of Agriculture's "Uniform Federal Assistance Regulations", 7 CFR 3015; "Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments", 7 CFR 3016; and/or "Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations", 7 CFR 3019; in addition to "Governmentwide Debarment and Suspension (Non-Procurement)", 7 CFR 3017; "Governmentwide Requirements for Drug-Free Workplace", 7 CFR 3021; "New Restrictions on Lobbying", 7 CFR 3018; and Office of Management and Budget regulations governing "Controlling Paperwork Burdens on the Public", 5 CFR 1320.

ARTICLE 9 – TITLE TO EQUIPMENT

APHIS reserves the right to transfer title to any equipment purchased partially or fully by the **Grantee** under this **Grant** with Federal funds within 120 days after receipt of the final inventory which is due 90 days after the end of the Federal support of the project for which it was acquired. Upon transfer of title, the Grantee will be entitled to compensation equal to its percentage of participation in the purchase of the equipment in the year purchased, applied to the fair market value in the year title is transferred.

ARTICLE 10 – PATENTS AND INVENTIONS

The **Grantee** has the explicit duty of notifying APHIS' authorized representative, in writing, prior to the time of application for any patent or invention which is paid for in any manner or any percentage of funds provided by APHIS. This duty is not limited to the period during the **Grant**, but may arise at any time during or subsequent to the **Grant**. APHIS reserves to itself a royalty-free, nonexclusive, and irrevocable right to use and authorize others to use the product or invention produced under this **Grant** for Government purposes. APHIS also retains the ability to force utilization of the patented invention by designating licenses in any field of use where the patentee has failed to act with reasonable diligence.

Any royalties or equivalent income earned during the effective period of this **Grant** on patents or inventions derived under this **Grant** shall be considered program income and treated under the provisions of 7 CFR 3019.24(b)(3).

ARTICLE 11 – COPYRIGHTS

APHIS reserves a royalty-free, nonexclusive, and irrevocable license to exercise, and to authorize others to exercise, the rights for Federal government purposes to copyrighted materials developed under this **Grant**. Subject to this license, the owner is free to exercise, preserve, or transfer all its rights. The **Grantee** shall ensure that no agreement is entered into for transferring the rights which would conflict with the nonexclusive license of APHIS.

Any royalties or equivalent income earned during the effective period of this **Grant** on copyrighted material derived under this **Grant** shall be considered program income and treated under the provisions of 7 CFR 3019.24(b)(3) as applicable.

ARTICLE 12 – PUBLICATIONS AND AUDIOVISUALS

The final draft of any funded publication or audiovisual must be submitted by the **Grantee** to APHIS' authorized representative prior to final printing, editing or release of the product so that APHIS can make a determination as to whether APHIS' participation in the project will be acknowledged. APHIS, furthermore, may require that the **Grantee** modify or purge any acknowledgment of its support for activities conducted under this **Grant** as a result of its review of a final draft. If APHIS has not responded within 30 days of receipt of the draft, the **Grantee** will be free to proceed with publication without an acknowledgment. In the event that APHIS elects not to acknowledge the product, the **Grantee** agrees not to attribute sponsorship by APHIS by any means including, but not limited to, publications, interviews, new releases, etc.

When an acknowledgment is desired by APHIS, unless otherwise instructed by APHIS, the statement shall read: "This material was made possible, in part, by a **Grant** from the United States Department of Agriculture's Animal and Plant Health Inspection Service (APHIS). It may not necessarily express APHIS' views."

Additionally, any other acknowledgment, including use of the APHIS Logo, by the **Grantee** of APHIS support shall have the express written permission of APHIS signatory to this Agreement, which shall be requested through the APHIS representative designated under this **Grant**.

ARTICLE 13 – BUY AMERICAN ACT

In the case of any equipment or product that may be authorized to be purchased with financial assistance provided using funds made available under the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act for the current Federal fiscal year, it is the sense of the Congress that entities receiving the assistance should, in expending the assistance, purchase only American-made equipment and products.

ARTICLE 14 – FUNDING PERIOD OBLIGATIONS AND EXTENSIONS

The funding period is the period during which this **Grant** is in effect. Any funds not obligated by the **Grantee** during the funding period will revert to APHIS upon the expiration or termination of this funding period. Under 7 CFR 3019.25, this **Grant** is subject to a one-time extension of up to 12 months to complete this project. The **Grantee** must submit a written request including an SF-424, Application for Federal Assistance, to extend the duration to be received by APHIS **at least 10 days prior to the expiration of the funding period.** The SF-424 must be accompanied by a justification explaining the reason for program delays, the program impact without the extension, and the anticipated completion date. During the extension period, financial and progress reports will continue with the same frequency as provided in the original funding period. As stated in 7 CFR 3019.25, requests for extension purely to obligate funds will be denied by APHIS. All extensions must be approved, in writing, by APHIS prior to the expiration of the original funding period.

ARTICLE 15 – NON-DISCRIMINATION CLAUSE

No person in the United States shall be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination in programs or activities funded in whole or in part by the United States Department of Agriculture based on race, color, national origin, age, disability, and, where applicable, sex, religion or political beliefs. Recipients will post a non-discrimination statement in accordance with USDA Departmental Regulation 4300-003 paragraph 7.b(2) found at http://www.ocio.usda.gov/directives/doc/DR4300-003.pdf .

ARTICLE 16 – TRAFFICKING IN PERSONS

APHIS, as the Federal awarding agency, hereby advises the **Grantee**, as the recipient, that they are subject to the provisions of the Trafficking Victims Protection Act of 2000 (TVPA), as amended (22 USC 7104(g), as follows:

a. Provisions applicable to a recipient that is a private entity.

(1) You, as the recipient, your employees, subrecipients under this award, and subrecipients' employees may not—

(a) Engage in severe forms of trafficking in persons during the period of time that the award is in effect;

(b) Procure a commercial sex act during the period of time that the award is in effect; or

(c) Use forced labor in the performance of the award or subawards under the award.

(2) We as the Federal awarding agency may unilaterally terminate this award, without penalty, if you or a subrecipient that is a private entity—

(a) Is determined to have violated a prohibition in paragraph a.(1) of this award term; or

(b) Has an employee who is determined by the agency official authorized to terminate the award to have violated a prohibition in paragraph a.(1) of this award term through conduct that is either—

i. Associated with performance under this award; or

ii. Imputed to you or the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 CFR part 180, "OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement)," as implemented by our agency at 7 CFR 3017.

b. Provision applicable to a recipient other than a private entity. We as the Federal awarding agency may unilaterally terminate this award, without penalty, if a subrecipient that is a private entity—

(1) Is determined to have violated an applicable prohibition in paragraph a.(1) of this award term; or

(2) Has an employee who is determined by the agency official authorized to terminate the award to have violated an applicable prohibition in paragraph a.(1) of this award term through conduct that is either--

(a) Associated with performance under this award; or

(b) Imputed to the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 CFR part 180, "OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement),' as implemented by our agency at 7 CFR 3017.

c. Provisions applicable to any recipient.

(1) You must inform us immediately of any information you receive from any source alleging a violation of a prohibition in paragraph a.(1) of the award term.

(2) Our right to terminate unilaterally that is described in paragraph a.(2) or b of this section:

(a) Implements section 106(g) of the Trafficking Victims Protection Act of 2000 (TVPA), as amended (22 USC 7104(g)), and

(b) Is in addition to all other remedies for noncompliance that are available to use under this award.

(3) You must include the requirements of paragraph a.(1) of this ward term in any subaward you make to a private entity.

d. Definitions. For purposes of this award term:

(1) "Employee" means either:

(a) An individual employed by you or a subrecipient who is engaged in the performance of the project or program under this award; or

(b) Another person engaged in the performance of the project or program under this award and not compensated by you including, but not limited to, a volunteer or individual whose services are contributed by a third party as an in-kind contribution toward cost sharing or matching requirements.

(2) "Forced labor" means labor obtained by any of the following methods: the recruitment, harboring, transportation, provision, or obtaining of a person for labor or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage, or slavery.

(3) "Private entity":

(a) Means any entity other than a State, local government, Indian tribe, or foreign public entity, as those terms are defined in 2 CFR 175.25.

(b) Includes:

i. A nonprofit organization, including any nonprofit institution of higher education, hospital, or tribal organization other than one included in the definition of Indian tribe at 2 CFR 175.25(b).

ii. A for–profit organization.

(4) "Severe forms of trafficking in persons," "commercial sex act," and "coercion" have the meanings given at section 103 of the TVPA, as amended (22 USC 7102).

ARTICLE 17 – FUNDING/EFFECTIVE PERIOD, REVISIONS, AND TERMINATION

The Federal award for this **Grant** is in the amount of 131,489. Cost overruns will be the sole responsibility of the **Grantee,** unless additional funding is secured from APHIS prior to the expiration of the funding period. This **Grant** shall become effective upon date of final signature and shall continue one year from the effective date, subject to continuation in writing by mutual agreement of the parties. Further, this **Grant** may be amended at any time during the effective period by mutual agreement of the parties in writing. It may be terminated following provisions of 7 CFR 3019.

UNIVERSITY OF DELAWARE
5 U.S.C. § 552 (b) (6)

1/15/2008

5 U.S.C. § 552 (b) (6) Contract & Grant Admin. Date

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ANIMAL CARE

Walter O. Hurrie for Dr. Gipson 1/25/2008

Deputy Administrator Date

Budget Object Class: 4117
Accounting Code: 867 6101 A12
Amount: $131,489

UNIVERSITY OF DELAWARE
COLLEGE OF AGRICULTURAL & NATURAL RESOURCES
AGRICULTURAL ANIMAL CARE AND USE COMMITTEE

Approval of Proposal
for Use of Agricultural Animals in Research

Proposal Title: **Scientific Investigation on the application of water based foam depopulation for floor reared meat birds and caged layers.**

Principal Investigator: 5 U.S.C. § 552 (b) (6) Bioresources Engineering

(b)(6)

Start Date: Nov. 30, 2007 End Date: Nov. 30, 2008

Description of Animals: Common Name: Chicken

Estimated Number: 390 Breed: Broiler and/or leghorn

Source: Spent layers / ISE America

Are all proposed animal care management procedures and experimental procedures (surgical, manipulative methods) defined as "pre-approved" by the Animal Care and Use Committee?

yes_____ no___X_____

If not, attach a description and justification for procedures not pre-approved.

If major modifications to animal facilities are proposed, attach a description and justification for those modifications.

If responsibilities beyond standard animal management practices are required of animal care personnel as part of the proposed project, please attach a description of those special duties.

5 U.S.C. § 552 (b) (6)

_____ 11/28/2007
Date

- -

Proposal Approved_____ Proposal Disapproved _____

Reason for Disapproval

_____ 11/28/2007
(b)(6) Date

Scientific investigation on the application of water based foam depopulation for floor reared meat birds and caged layers.
Cooperative Agreement

Principal Investigators:
University of Delaware
5 U.S.C. § 552 (b) (6)

Department of Bioresources Engineering
5 U.S.C. § 552 (b)
(6)

5 U.S.C. § 552 (b) (6)

Department of Animal and Food Science

5 U.S.C. § 552 (b)
(6)
Department of Animal and Food Science

5 U.S.C. § 552 (b) (6)

Department of Bioresources Engineering

5 U.S.C. § 552 (b) (6)

Start Date:
November 30, 2007

End Date:
November 30, 2008

Cooperative Agreement
Problem Statement
The spread of avian influenza virus (AIV) poses a serious threat to poultry populations and a potential threat to humans. An outbreak of high pathogenic avian influenza virus (HPAIV) H5N1 virus has caused at least 165 human fatalities in Asia since 2003 (Who, 2007). The cost to the Asian poultry market has been the destruction of over 200 million birds. The United States has been fortunate in that most outbreaks within the US have been of the low pathogenic avian influenza virus (LPAIV) that has less of a zoonotic potential. Most recent disease outbreaks in the US have been quickly contained. The US has suffered HPAIV outbreaks such as the 1983 Pennsylvania H5N2 outbreak in which 17 million birds were destroyed at a cost of US$61 million (Goldblatt, et al., 2004; Lu, et al., 2004). More recently, an outbreak of LPAIV in Delaware and Maryland resulted in a ban on the import of US poultry in thirty nations in 2004 (Capua and Alexander, 2004; Montgomery, 2004).

The economic impact of AIV outbreaks can be devastating, particularly in heavy poultry production areas such as Delmarva. The economic impact was magnified by the lack of appropriate depopulation techniques. In 2004, the CO_2 polyethylene tent procedure was used to

depopulate approximately 400,000 birds infected with LPAVI on Delmarva. In the CO_2-polyethylene tent procedure the birds are covered with clear, semi-opaque or black polyethylene and the volume of air under the polyethylene sheet is replaced with CO_2 gas. When subjected to high levels of CO_2, birds are anesthetized, and then begin terminal convulsions before dying of hypoxia.

The CO_2-polyethylene tent procedure used in Delaware was similar to the techniques employed in the 2002 Virginia AIV outbreak. Depopulation was handled in Virginia using two controlled atmosphere methods. The first method involved constructing a ground panel enclosure. A rectangular plywood enclosure was built at one end of a turkey house and covered by a tarp supported by a zigzag rope truss to prevent sagging (Kingston, et al., 2005). Turkeys were herded in to the enclosure in batches of 5,500 birds and an average of 6 min 20 s were required for audible signs of activity to cease. In a second procedure for caged birds, a metal enclosure was placed over birds in live haul cages on a flatbed truck. The second technique also required the euthanasia of birds in batches, with the cessation of audible signs of activity occurring at an average of 1 min 28 s for 375 chickens.

The problems with the existing depopulation techniques lead to the development of a new depopulation technique using water based foam. The development of the water based foam procedure was initially funded through CANR seed grant funding, which lead to additional funding from the US Poultry and Egg Association and US Department of Agriculture Animal and Plant Health Inspection Service (APHIS). The use of water based foam was found to be faster than current depopulation techniques (Benson, et al., 2007; Dawson, et al., 2006). Corticosterone analysis indicates that the stress experienced by the birds depopulated with foam was equal or less than the stress experienced during CO_2-polyethylene tent treatment (Benson, et al., 2007). In 2006, the use of water based foam was approved by USDA-APHIS for emergency depopulation when the poultry are infected with a potentially zoonotic disease, are experiencing an outbreak of a rapidly spreading infectious disease or are housed in structurally unsound buildings that would be hazardous for human entry.

The initial research at the University of Delaware documented that the foam procedure was effective for broilers. Research conducted in conjunction with the North Carolina Department of Agriculture documented the effectiveness of foam with turkeys (Howard, 2007). In late 2006, additional research at the University of Delaware documented the effectiveness of foam on commercial ducks.

The research at the University of Delaware showed that CO_2 gas infused foam was no more or no less effective than foam without gas. In particular, internationally, there is a preference for foam with CO_2, which may provide an anesthetic effect prior to cessation of activity. In Europe, there has been research into potential depopulation methods that would provide for high concentrations of gas in the foam. For this reason, additional research on the use of CO_2 gas infused foam for meat type birds is required.

The techniques developed for floor reared poultry are not effective for cage reared poultry. In a floor reared poultry operation, the birds are typically raised in one open large space with minimal obstruction. The configuration of most cage reared poultry makes access to the birds difficult. In caged layer operations, up to eight to ten levels of cages will run the length of the building with only minimal aisles, perhaps 2 feet (0.6 m), between cages. Layer houses can be two stories, with manure storage below the main cage areas. The loadout doors are relatively small (8 ft x 8 ft, 2.4 m x 2.4 m) and typically above grade.

There are a limited number of techniques available for depopulation of caged layers. Of the techniques available, some of the techniques are more suited to depopulation of spent hens than mass emergency depopulation. Three techniques available for depopulation of caged reared poultry include whole house gassing, live catch and gassing and the use of modified atmosphere carts. Whole house gassing involves sealing the house and applying gas, such as CO_2, to fill the

entire house. A manifold or distribution system, a well sealed house and a large quantity of gas are required for effective depopulation. The expansion of CO_2 from a liquid to gas causes a rapid drop in temperature, freezing the birds near the discharge areas inside the house. In addition, after gassing, the bird carcasses need to be handled and removed from the cages and the process is made more difficult if the carcasses have gone through rigor mortis (Shere, 2006). Modified atmosphere carts are an option for some situations. With a modified atmosphere cart, a small airtight cart is equipped with a gas mixture such as CO_2. The cart is pre-charged with the gas mixture, moved down the aisles between the cages and birds are added to the cart. The carts can hold approximately 250 birds before needing to be emptied (Webster, et al., 1996). With live catch procedures, the birds are hand caught in the cages and carried to a roll off container or similar. The roll off chamber is filled with birds, sealed and carbon dioxide gas is applied to the sealed chamber. The procedure is tiring and requires continued handling of live birds and some times results in birds smothering rather than euthanized by gas. With the live catch procedure, depopulation rates of up to 70,000 birds per day can be achieved in a layer operation (Shere, 2006). In the United States, there is resistance to removing the dead birds from cages, however, in Canada there is less resistance to removing dead birds from cages (Howard, 2007).

Initial work with water based foam and caged layers, indicates that there is additional work required to make the procedure viable. In one experiment, caged layers were removed from their cages and placed into a large container. Foam was applied over and around the removed birds; however, bird mortality was not suitable as some birds were able to find pockets or air spaces (Howard, 2007). Animal welfare is a concern during depopulation and leghorns are more active than broilers. The proposed procedure is intended for mass emergency depopulation, not routine removal of spent hens.

Foam has met the needs of the meat type poultry industry. This procedure was used for the first time in April 2007 in West Virginia to depopulate 25,000 turkeys. Current foam procedures; however, were developed for floor reared poultry. The layer industry is demanding a viable procedure. From an animal welfare standpoint, an effective in-cage depopulation system would eliminate potential stress and injury associated with removing live birds from cages and the handling of birds for gassing in or immediately outside the house.

Objective

This project will address the practical factors associated with the use of water based foam for caged layers. Specifically, the project will:

A. Develop and evaluate technologies for water based foam depopulation of meat type birds and caged layers.

B. Evaluate the impact of time and the onset of rigor mortis on removal of birds from cages.

C. Measure and compare the bird stress due to foaming in cage, removal from cage with transport to depopulation, and removal from cage and immediate gassing.

D. Maintain and update and educational module on foam depopulation

Project Description
Objective A
Develop and evaluate technologies for water based foam depopulation of caged layers.

Justification
There is little information on the use of water based foam depopulation techniques on caged layers. There is evidence to suggest that cages may provide resistance to the entrance or exit of foam from the cage. This may be an advantage for foaming since the foam will remain in the cage during depopulation, however, this may pose a problem for filling the cages with foam. The preferred technique is to apply foam from some distance from the cage and allow the foam to flow into the cage. Methods requiring direct foam application into the chamber will require additional time and increase the complexity of the equipment.

Procedure
Currently available foam equipment including foam with inert gas and foam without inert gas will be systematically tested.

In Objective A, currently available water based foam equipment including the Kifco AviGuard, Spumifer AG-1, Amerex Model 250, and Ansul Mini-Fomax will be used to evaluate the foam with and without inert gas. In particular, the Ansul Mini-Fomax and Amerex Model 250 generator will be used to test depopulation inert-gas infused foam. The Amerex Model 250 is ideal for this application because the gas used to create the foam can be completely controlled. Water infused carbonated water may be used to increase the gas content of the produced foam.

The equipment will be evaluated on the ability of the equipment to depopulate birds and the impact on welfare. The primary inert gas of choice will be CO_2, however, alternative gas mixtures including Ar/CO_2 may be used. If the standard equipment does not prove suitable, the equipment may be modified to improve foam characteristics.

The goal of Objective A will be to a) determine whether the birds died of foam or due to CO_2 and evaluate the time of unconsciousness in both foam with CO_2 and foam without CO_2.

To evaluate the impact of foam with and without inert gas on depopulation, EEG, ECG, and accelerometer equipment will be used to simultaneously monitor brain and heart activity. A wireless telemetry system (DataScience International) will be used to monitor brain activity (EEG). An existing tethered telemetry system (BIOPAC Systems, Inc. Student Laboratory edition or equivalent) will be used to monitor heart activity. An acceleration sensor will be used to monitor leg and gross body movement.

A screening study will be performed to select the most appropriate foam without gas, foam with inert gas, and a CO_2 control treatment. The foam depopulation technology may be chosen from the Kifco style foam generator system, medium expansion foam generator and/or reduced scale systems appropriate for laboratory use. Dye may be added to the foam to improve visualization of the movement of the foam within the bird. Treatment will occur within a 50 gallon (189 liter) polycarbonate chamber or similar. Wireless telemetry receivers will be located in the treatment chamber.

Prior to the experiment, testing will be conducted to determine the release time of gases from foam. The Amerex Model 250 will be charged with CO_2 or O_2 and used to produce high concentration gas. Oxygen rather than CO_2 may be used because of the ease of getting appropriate sensors for high gas concentrations. An appropriate sensor will be located inside a gas tight chamber and foam will be released into the chamber through a check valve. The time rate of increase in the gas concentration will be monitored through the sensor. The results from this will be compared to pre-existing data on cessation time of birds in foam.

Gas flow rates and flow times will be recorded. Bird activity will be monitored using a PCB Piezioelectric accelerometer 352C66 or similar attached to the right leg. Carbon dioxide levels will be recorded at 60 s using GasTec 0 – 100% CO_2 dosimeter tubes or alternative gas monitoring equipment. Oxygen sensors (OxyCheq or equivalent) may be located inside the chamber to determine O_2 level. Temperature sensors may be located within the chamber as well. Electronic sensors will be recorded using National Instruments LabVIEW software.

A wireless telemetry implant (Data Science International F50-EEE or equivalent) will be implanted in the broiler via surgery prior to testing (Savory and Kostal, 2006; Savory and Kostal, 1997). The implant will be sterilized using a cold chemical sterilization liquid (Cidex® (Johnson & Johnson Company) or equivalent) prior to the procedure. The implant serial number, calibration constants, and channel will be recorded prior to surgery. Anesthesia will be induced using isoflorothane or using a similar accepted anesthesia procedure via a nasal hood. After anesthesia, tracheal intubation will replace the nasal hood. The bird will be secured on the operating table and the feathers plucked from the skull near the comb. A local disinfectant will be used to clean the area near the surgery site. A 5 cm incision will be made near the comb. A hemostat will be used to insert the body of the wireless transmitter down along the axis of the neck, under loose skin. Two additional incisions may be made parallel to the axis of the comb to expose the skull. After exposing the posterior skull, the bone there will be scraped and 3 holes 1 cm apart and 1.5 cm behind the comb will be drilled through the bone with a hand-held mm diameter bit, to expose the surface of the telencephalon. One hole will be for each EEG lead, while the third hole will be for the common ground. One channel of the three biopotential transmitter will be used for EEG. The leads will be cut to an appropriate length, their exposed ends bent through 90 degrees and inserted in the holes and anchored in position using cyanoacrylate or VetBond with the tips of the sensing electrodes touching the telencephalon. Cyanoacrylate accelerator may be used to speed the drying of the adhesive. The second channel of the three biopotential transmitter will be used for EMG. For EMG, the leads will be stripped back and the exposed ends will not be bent back. The leads will be inserted in the neck or upper shoulder muscle using an 18 gauge needle. The leads will be secured with cyanoacrylate or VetBond. The third channel is being reserved for future use. The operation areas will be treated with antibiotics, the skin incisions closed and the chicken will be allowed to recover on with 100% oxygen. While the bird is under anesthesia, areas on the wing and body will be plucked and prepared for ECG surface pad sensors. After recovery, the bird will be placed on heating pads and monitored. Birds will be allowed to recover for 24 to 48 hours before depopulation. The output from the radiotelemetry system will be checked prior to beginning any depopulation work.

On the day of treatment, ECG pads will be affixed to the bird in the prepared locations. The birds will be placed in a polycarbonate chamber equipped with Data Sciences International RPC-1 antenna or equivalent. Output from the EEG and ECG sensors will be checked prior to beginning treatment. Treatments will be randomized to avoid testing effects. Multiple video cameras will be located to record the activity of the bird. Prior to treatment, EEG and ECG baseline data recording will begin.

A total of 45 birds are required for the experiment. There will be up to three treatments with up to fifteen birds per treatment required to ensure statistical validity.

This experiment may be repeated with both meat type birds and caged layers. Any experiments with caged layers will include an evaluation on the ability of the equipment to effectively penetrate the cage, depopulate the birds, and the welfare considerations. In the case of caged layers, prior to any bird testing, currently available equipment will be tested on empty layer cages to determine the ability to determine the ability of the foam to enter and flow from the cage.

Custom software was written by the research group to allow interpretation of the ECG data. Due to the proprietary format of the EEG data, this is not an option for the EEG and EMG data. Data Science International sells an additional cost software package NeuroScore) that was not purchased during the initial purchase. A limited duration (30 day) test version of the software was

secured and used to evaluate the software. Although the software was initially created for other applications, the test version of the NeuroScore software indicated that the full version of the Data Science software would allow analysis of the results.

Objective B

Evaluate the impact of time and the onset of rigor mortis on removal of birds from cages.

Justification

One of the problems of depopulating caged layers is removing the bird from the cage. Is it faster and more humane to remove the birds from the cages prior to culling or should the birds be depopulated and then removed from the cage. In addition, is there a time after which the body will begin to relax sufficiently to better facilitate removal of the bird from the cage?

Rigor mortis is caused by a chemical change in the muscles after death, causing the limbs of the corpse to become stiff (Latin rigor) and difficult to move or manipulate. For humans, rigor usually sets in about 3-4 hours after clinical death, with full rigor being in effect at about 12 hours, and eventually subsiding to relaxation at about 72 hours. The onset of rigor moritis is caused by the loss of adenosine triphosphate (ATP) from the muscles. Hypoxia prevents the synthesis of ATP and as the level of ATP begins to fall, actin and myosin filaments combine irreversibly to cause rigor mortis to set in (Kobayashi et al., 1996). For turkeys, the time for rigor mortis completion in fillets from unstunned turkeys has been reported to be 143 min, compared with 314 min in stunned birds (Ma and Addis, 1973). For broilers, rigor mortis develops in 180 min to 360 min under refrigeration (Cavitts and Sams, 2003). Temperature is a key component in the time required for the rigor mortis development. The onset of rigor mortis and the onset of stiffness in rats was studied by Kobayashi et al (2004). There were variations in stiffness due to temperature and muscle type. Rigor mortis (as measured by a 10% increase in stiffness) occurred within 71 to 124 minutes at 25º C and within 29 to 60 minutes at 37º C. Full stiffness (100% stiffness) occurred within 266 to 319 minutes at 25º C and within 81 to 128 minutes at 37º C. Times for the onset of rigor mortis can vary from a few minutes to several hours depending on the ambient temperature. The time of rigor mortis is influenced by age, condition of the body, temperature, mode of death and activity prior to death. For depopulation of caged birds, rigor mortis influences whether it will be faster to remove the birds from the cage prior to death or after death.

Measurement of rigor mortis can be performed multiple ways. Kobayashi et al (2004) cut small portions of muscle from the cadaver, and mounted the specimens in a water jacketed tissue bath containing liquid paraffin. One end of the specimen was attached to a servo motor and the second was attached to a strain gauge. A sequence of rapid stretch and release cycles was used to determine the development of rigor. Similar processes have reported by others and a Bates Smith Rigormeter was developed at one time, however, there are no known manufacturers or distributors for the device. In other studies, the concentrations of ATP, adenosine diophosphate (ADP), adenosine monophosphate (AMP) and acetic acid were measured (Kobayashi, et al., 1996). Measuring chemical composition in the muscle, however, documented differences in rigor between muscles that were not clearly explainable. Cavitt and Sams (2003) used postmortem muscle pH, R-value, and shear value to monitor rigor mortis development in broiler carcasses. In addition, Cavitt and Sams measuring physical changes in broiler carcass dimensions of the shoulder, elbow, and wing tip. In particular, they found that the elbow distance measurement was repeatable and useful for measuring rigor, while wing tip distances were not reliable for measuring rigor. Elbow distance decreases significantly over time due to the progressive rate of rigor development within broiler carcasses over time.

Procedure

Spent layer hens (30 in 3 x 10 bird treatments) will be marked with wing badges to allow for continued monitoring of the same birds. The spent hens will be humanely euthanized using carbon dioxide and placed in multiple cages at standard stocking density. For birds treated with foam, birds will be humanely euthanized using cervical dislocation, placed in the cages and foam applied on and around the bird. At regular time intervals, the birds will be evaluated to determine the extent of rigor mortis. The elbow distance measurement method of Cavitt and Sams (2003)

will be tested prior to the experiment and used as the primary measure of rigor development. In addition to evaluating when the bird reaches clinical signs of rigor mortis, the ease of removal of the bird from cages will be evaluated.

After rigor mortis is established, the birds will be periodically evaluated at regular time intervals to determine if the body has softened sufficiently to facilitate removal. Again, the ease of removal from the cage will be evaluated. Ease of removal will be evaluated on a 1 to 10 scale.

The ambient temperature conditions will be recorded using a Kestrel or similar combination temperature and humidity sensor. Bird temperature will be recorded from each bird via the cloacal method using a digital thermometer prior to depopulation and at regular intervals post-euthanasia. This experiment may be conducted indoors in the Allen Laboratory, a BSL 3 facility with humidity and temperatures to maintain a consistent appropriate temperature (70º +/- 1º F).

This experiment will be repeated during both winter and summer conditions to determine the impact of temperature on ease of removal from cages. Within each experiment, the process may be repeated up to three times with two different cages and once with the birds wet with foam. In particular, one cage will be selected to have a minimal cage door opening and one cage will be selected to represent a more modern cage design.

Objective C
Measure and compare the bird stress due to foaming in cage, removal from cage with transport to depopulation, and removal from cage and immediate gassing.

Justification
In broilers, foam was found to be no more stressful than CO_2 gassing. In caged layers, the foam may flow around the birds very differently than for floor reared poultry. In addition, in caged layers, the alternatives require significant handling of the birds.

Procedure
Three procedures will be compared: foam, removal from cage with transport and depopulation, and removal from cage with gassing. Ten spent layers will be marked with unique wing bands to identify the bird and treatments and placed in a standard cage and different cages may be used for each treatment, with up to three replications per treatment and three treatments, for a total of 90 identified birds. Up to 200 additional spent layers may be added to more accurately reflect typical conditions. Where practical, one bird per treatment will be equipped with ECG and/or acceleration sensors to monitor cessation of activity. Pretreatment blood samples will be taken from each marked bird by direct draw.

The most effective foam procedure from Objective A will be used as one procedure. The foam will be applied around the birds through the cage under low light intensity. Immediately after cessation of activity, the birds will be removed from the cage and a post-mortem blood sample via the direct heart draw will be extracted.

Pre-treatment and post-mortem blood samples will be analyzed at Pennsylvania State University or a commercial laboratory for heterophil / lymphocyte ratio and corticosterone levels. Where possible, blood-gas analysis will be done on birds killed with foam generated with ambient air and foam generated with CO_2 to determine if indeed the gas is the cause of death. Corticosterone concentration has been used as a measure of environmental stress in chickens; however, heterophil / lymphocyte ratio is a more reliable indicator of social stress than plasma corticosteroid level (Gross and Siegel, 1983).

For the transportation and depopulation treatment, a poultry science technician will serve as a trained catcher. The birds are placed in pullet or fowl carts, transported to the end of the house, removed and dropped into containment units for gassing. After cessation of activity at the end of gassing, a blood sample for corticosterone will be extracted.

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at PSU. 5 U.S.C. § 552 (b) (6) will commit 1% effort to meet the minimum matching requirement. Their actual commitment to the project may be higher.

Support for undergraduate research students ($6,000), a masters or doctoral degree graduate student ($22,000) and technician (2.0 months, $10,000) to support the listed experiments is requested.

Fringe Benefits
University of Delaware Fringe benefit rates are 34% for faculty, staff and technicians, 4% for graduate students, and 8% for undergraduate students.

Travel
Travel funds ($4,000) are requested for one scientific presentation and for local travel to and from test site and/or meeting with USDA representatives. Six trips are estimated to or from University Park, PA (Pennsylvania State University) to Newark, DE (University of Delaware), with per diem for food and up to one night of lodging for three of the trips. Included in this component are costs to travel to an appropriate site to document lessons learned. One scientific presentation is estimated at $1,200 including airfare, lodging, and entrance fees.

Equipment
No additional equipment is requested.

Materials and Supplies
Objective A ($24,000) will require foam concentrate, modifications to foam equipment, raising, transporting and/or securing birds, and other consumables. In addition, Objective A will require surgical supplies, gassing equipment, securing birds and additional consumables.
A significant expense is the purchase of Data Science International NeuroScore to analyze brain (EEG), muscular (EMG), and cardiac (ECG) activity ($7,000). One additional EEG receiver ($926) and transmitter ($2,630) are requested. In addition, the three current EEG transmitters require annual refurbishment and battery recharge ($400 each).

Objective B ($2,500) will require securing birds, foam concentrate, and additional consumables.

Objective C ($7,400) will require blood sampling ($5,000), securing birds and additional consumables.

Objective D ($10,000) to develop and implement a password protected depopulation module.

Costs are included for purchase of a gas analyzer ($1,750) to properly monitor gas levels during comparison procedures.

Publication Costs
Support for publication and dissemination of results in one scientific journal (Poultry Science, Journal of Applied Poultry Research or equivalent) ($1,000).

Indirect Costs
The federally negotiated indirect cost rate for a research proposal in the College of Agriculture and Natural Resources is 29.2%. Since APHIS limits the indirect costs we can charge to 20%, the difference of 9.2% is listed as match.

References
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For the removal from cage with gassing treatment, a catcher will remove the birds from the cage and place the bird into a depopulation cart or a transport cage. If the depopulation cart is used, the depopulation cart will be pre-charged with gas and the birds placed directly within the cart. If the transportation cage is used, it will be loaded, placed within a chamber, and gassed with CO_2.

The pre-treatment and post-mortem levels will be compared using SAS Proc Univariate or similar procedure and/or Microsoft Excel analysis of variance.

Time and consumption of materials will be recorded.

Objective D
Maintain and update and educational module on foam depopulation

Justification
The technology for foam depopulation has been demonstrated to a variety of audiences. A number of companies are beginning to adopt the technology; however, equipment is only part of the equation. Recent outbreak responses in West Virginia and Virginia highlight the need for additional education and training.

Procedure
An online, password protected module on foam depopulation will be developed. The module would include audio and visual media and would be made available through a password protected portion of the UD Avian Bioscience Center.

The module would include information on both the theoretical basis for foam and the lessons learned during actual responses.

As part of this objective, if there is an appropriate outbreak of AIV in the United States, the project team will travel to the site to document lessons learned.

This module may involve the use of external web development contractors if the internal resources prove insufficient.

Project Management:
5 U.S.C. § 552 will serve as the project director for the project. 5 U.S.C. § 552 (b) (6) engineering modifications to the equipment and/or sensors.

5 U.S.C. § 552 (b) (6) will coordinate field activity. 5 U.S.C. § 552 (b) (6) the development of the online education module.

5 U.S.C. § 552 (b) (6) will manage bird health and coordinate EEG surgery.

5 U.S.C. § 552 (b) (6) will serve as an external consultant for the project. 5 U.S.C. § 552 (b) (6) in a portion of the experiments and will coordinate the analysis of the blood samples.

Budget justification

The total requested budget is $131,489.

Salaries and Wages
Funds are requested to support 5 U.S.C. § 552 (b) (6) with a 9 month appointment, for one month of summer salary.

No funds are requested to support 5 U.S.C. § 552 (b) (6) for their involvement in the activity at UD. No funds are requested for 5 U.S.C. § 552 (b) (6) activity

	Overall Budget					
		Year 1				
A. Personnel	Person (time period)					
PI and Co-PI		$ 8,556				
		$ -				
	(b)(6)	$ -				
		$ -				
		$ -				
		$ -				
Research Assistant		$ 10,000				
Grad Students		$ 22,000				
Post doc with fringe		$ -				
Post doc without fringe		$ -				
Students (summer)		$ 5,000				
Students (semester)		$ 1,000				
Secretary Support		$ -				
Total Personnel		$ 46,556				
B. Fringe Benefits	Rate					
PI and Co-PI	34.0%	$ 2,909				
Research Assistant	34.0%	$ 3,400				
Grad students	4.0%	$ 880				
Post Doc with Benefits	30.0%	$ -				
Post Doc without benefits	0.0%	$ -				
Students (summer)	8.0%	$ 400				
Students (semester)	8.0%	$ 80				
Secretary support	43.5%	$ -				
Total Fringe Benefits		$ 7,669				
Total Salary and Fringe		$ 54,224				
C. Travel	Purpose	$ -				
	Data collection	$ 4,000		6 trips to or from PSU, 200 mi one way, $0		
	Presentation	$ 1,200		1 scientific presentation, airfare, entrance,		
		$ -				
Total Travel		$ 5,200				
D. Equipment						
$5,000 or more (no indirect costs)		$ -				
		$ -				
E. Supply						
Objective A		$ 24,000.00				
Objective B		$ 2,500.00				
Objective C		$ 7,400.00				
Objective D		$ 10,000.00				
Instrumentation		$ 1,750.00				
Misc		$ 3,500.00				
Total Supply		$ 49,150	$ -			
F. Contracts	1st 25,000	$ -				
	over 25,000 (no indirect costs)	$ -				
Total Contracts		$ -				
G. Other	Item					
	Refereed publication	$ 1,000				
Total Other		$ 1,000				
	Totals					
H. Total Direct costs		$ 109,574				
Modified Direct costs		$ 109,574				
I. Indirect costs	20.0%	$ 21,915				
J. Total Project cost	H+I	$ 131,489				
K. Total request		$ 131,489				

Scientific investigation on the application of water based foam depopulation for floor reared meat birds and caged layers.

Budget Justification Notes:

The total requested budget is $131,489.

Travel
Travel funds ($4,000) are requested for one scientific presentation and for local travel to and from test site and/or meeting with USDA representatives. Six trips are estimated to or from University Park, PA (Pennsylvania State University) to Newark, DE (University of Delaware), with per diem for food and up to one night of lodging for three of the trips. Included in this component are costs to travel to an appropriate site to document lessons learned. One scientific presentation is estimated at $1,200 including airfare, lodging, and entrance fees. All scientific and support travel is included in the travel buidget.

Equipment
No additional equipment is requested.

Materials and Supplies
Objective A ($24,000) will require foam concentrate, modifications to foam equipment, raising, transporting and/or securing birds, and other consumables. In addition, Objective A will require surgical supplies, gassing equipment, securing birds and additional consumables.
A significant expense is the purchase of Data Science International NeuroScore to analyze brain (EEG), muscular (EMG), and cardiac (ECG) activity ($7,000). One additional EEG receiver ($926) and transmitter ($2,630) are requested. In addition, the three current EEG transmitters require annual refurbishment and battery recharge ($400 each). The NeuroScore software is considered software, not equipment, and included under Materials and Supplies.

Objective B ($2,500) will require securing birds, foam concentrate, and additional consumables.

Objective C ($7,400) will require blood sampling ($5,000), securing birds and additional consumables.

Objective D ($10,000) to develop and implement a password protected depopulation module. This portion may included additional software (i.e. Adobe Creative Suite 3) and/or server capacity. This portion may be outsourced depending on demand.

Costs are included for purchase of a gas analyzer ($1,750) to properly monitor gas levels during comparison procedures.