Decision Support & Research Partners

- USDA Animal & Plant Health Inspection Service
- US Naval Medical Research Unit-2
- US DoD GEIS Central Hub
- US CDC Influenza Division
- US CDC Global Disease Detection Program
- Wetlands International Indonesia Programme
- Cobb Indonesia
Multiple Products

Cobb 500
Cobb 700
Cobb AVIAN 48

Multiple Markets

Cobb-Vantress offers a full range of products, each specifically developed to maximize your bottom line profitability.
Whether the objective is high meat yield, the day-old chick market or a balance of both, our customized product lines are designed to fulfill individual commercial expectations.

We're Cobb
Primary Broiler Breeders
www.cobbindo.co.id
INDONESIA

Cobb500™
The worlds most efficient

The world’s most efficient broiler has the lowest feed conversion, best growth rate and an ability to thrive on low density, less costly nutrition. These attributes combine to give the Cobb500™ the competitive advantage of the lowest cost per kilogram or pound of live-weight produced for the growing customer base worldwide.

The Cobb500™ has:
• Lowest cost of live weight produced
• Superior performance on lower cost feed rations
• Most feed efficient
• Excellent growth rate
• Best broiler uniformity for processing
• Competitive breeder
GOALS

- Reduce the economic loss of consumers and poultry industries
- Reduce human morbidity and mortality by limiting human infection
- Reduce the likelihood of forming pandemic strains due to co-infection in humans

OBJECTIVES

- Estimate the spatiotemporal risk for poultry outbreaks and for human infection
- Model on-farm and off-farm spread of H5N1 viruses
- Predict seasonal influenza transmission and provide pandemic early warning
National Strategy for Pandemic Influenza

THREE PILLARS

- Preparedness & Communication
- Surveillance & Detection
- Response & Containment
Projected Deaths in US For Pandemics With Severity 1–5

<table>
<thead>
<tr>
<th>Category</th>
<th>CFR</th>
<th>Pandemic</th>
<th>Deaths in US</th>
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<tbody>
<tr>
<td>1</td>
<td>&lt; 0.1 %</td>
<td>1918 Spanish Flu</td>
<td>~ 500 K</td>
</tr>
<tr>
<td>2</td>
<td>0.1 – 0.5 %</td>
<td>1957 Asian Flu</td>
<td>70 K</td>
</tr>
<tr>
<td>3</td>
<td>0.5 – 1.0 %</td>
<td>1968 HK Flu</td>
<td>34 K</td>
</tr>
<tr>
<td>4</td>
<td>1.0 – 2.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>&gt; 2.0 %</td>
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Source: USG Prepandemic Planning Guidance
<table>
<thead>
<tr>
<th>Project Capabilities That Can Be Used To Support End Users’ Missions</th>
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<tbody>
<tr>
<td>Spatiotemporal AI infection risks for poultry &amp; humans</td>
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<tr>
<td>On- &amp; Off-farm spread of HPAI viruses</td>
</tr>
<tr>
<td>Seasonal influenza &amp; pandemic early warning</td>
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<table>
<thead>
<tr>
<th></th>
<th>APHIS</th>
<th>Cobb Indo</th>
<th>NAMRU2</th>
<th>CDC</th>
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<tr>
<td>Spatiotemporal AI</td>
<td>X</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>infection risks for</td>
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<tr>
<td>poultry &amp; humans</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>of HPAI viruses</td>
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<tr>
<td>Seasonal influenza</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>&amp; pandemic early</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>warning</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Hemaglutinin
A glycoprotein for binding to the host cell
16 types

Neuraminidase
An enzyme for splitting mucoprotein in order to release progeny
9 types

H1N1 + H2N2 \rightarrow H1N1, H2N2, H1N2, H2N1
Human & Avian Influenza Epidemics & Pandemics

- **Spanish Flu**: 1918
  - 28% world infected with 20-50M deaths
  - > 0.5M deaths in US
- **Asian Flu**: 1957
  - 70K deaths in US
- **Hong Kong Flu**: 1968
  - 34K deaths in US
- **pH1N1**: 1997
  - 15K deaths worldwide
  - 16% US infected
- **SARS (coronavirus)**: 2003
  - 37 countries
- **Human & Avian Influenza Epidemics & Pandemics**
- **H5N1 Outbreaks**
  - 1996: H5N1 in Hong Kong
  - 1998: H9N2 in Guangdong
  - 2003: H7N7 in Holland
  - 2004: H7N3 in Canada
  - 2004: H5N1 in China
  - 2009: H1N1 (pH1N1)
The 2003 SARS Outbreaks

SARS increased public health as well as the general public’s awareness of the seriousness of pandemic, and provided a real test ground for preventing and controlling respiratory disease.
WHO Global Influenza Surveillance Network

Cities studied in Avian, Seasonal & Pandemic Influenza Project

Legend
- National Influenza Centres
- WHC Collaborating Centres for Reference and Research on Influenza
- WHC Collaborating Centre for Studies on the Ecology of Influenza in Animals
- Reference laboratories

4 WHO Collaborating Centers
112 WHO National Influenza Centers in 83 countries

Epidemic and Pandemic Alert and Response
WHO Global Influenza Surveillance Network

Countries or regions that have been approached in the Global Influenza Project

Legend:
- National Influenza Centres
- WHC Collaborating Centres for Reference and Research on Influenza
- WHC Collaborating Centre for Studies on the Ecology of Influenza in Animals
- Reference laboratories

This project can contribute to GEO HE-09-02e and HE01 C1

Epidemic and Pandemic Alert and Response
H5N1 TRANSMISSION PATHWAYS

POULTRY TRADE
poultry, products, feed, waste, personnel, equipment

BIRD TRADE
LPAI spill over
HPAI spill back

MIGRATORY BIRDS
wild birds
domestic birds
ducks & geese

POULTRY
Sectors 1&2  Sectors 3&4

HUMANS
human flu virus
reassortment
pandemic strain

richard.kiang@nasa.gov
Asymptomatic Infection or Mild Illness?

- Asymptomatic or mild H5N1 virus infection documented in Hong Kong, 1997
  - 10% of Poultry Workers+ for H5N1 antibodies (N = 1525) single serum specimen (avian-to-human transmission)
  - 3% of government poultry cullers+ for H5N1 antibodies, paired sera; 1 seroconverted (N = 293)

- Frequency of asymptomatic or mild H5N1 virus infection since 1997 is unknown

Source: T. Uyeki/CDC

Transmission through Waterfowl and Poultry And Control Options

Wild waterfowl → Domestic waterfowl → Poultry → Vaccination or culling

Source: R. G. Webster /St. Jude
NAMRU-2 Surveillance Sites
For Migratory, Resident and Captive Birds

Source: A. C. Stoops/NAMRU-2
NAMRU-2 Surveillance Sites
And Locations of Reported Human Cases

Source: A. C. Stoops/NAMRU-2
RNA was extracted from swabs; RT-PCR was conducted for H5N1 genes; antibodies was detected using hemagglutination inhibition and other tests.

Species with the highest seropositive rates in each category are Muschovy duck (captive), striated heron (non-migratory) and Pacific golden plover (migratory).

16% of the captive birds (duck, swan, pigeon, etc.) showed H5N1 antibody.

Infected captive birds can be asymptomatic.

In Indonesia, the role of migratory birds in H5N1 transmission is limited.
The role of migratory birds in the spread of H5N1 remains under considerable debates.

In Indonesia, migratory pathways are only known for shorebirds (East Asian-Australasian flyway) and migratory ducks and geese (East Asian & Central Asian flyways).

4067 birds comprising of 98 species and 23 genera were collected in 2006-2007.

Most common birds: striated heron, common sandpiper, and domestic chicken.
Neighbor-joining (NJ) tree of 121 H5N1 HA sequences constructed using PAUP* v4.0b10 with 1,000 bootstrap replicates. The tree was rooted using A/goose/Guangdong/1/1996. Estimates of the statistical significance of phylogenies were calculated by performing 1,000 neighbor-joining bootstrap replicates. Scale bar represents 0.005 nucleotide changes.

Phylogenetic Tree of Hemagglutinin from H5N1 Viruses

Clade 2.1 is specific to Indonesia

Source: WHO, January 2009
## Results of NAMRU-2 Bird Surveillance Study

<table>
<thead>
<tr>
<th></th>
<th>ELISA H5 Positive</th>
<th></th>
<th>rRT-PCR H5 Positive</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>+</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Captive birds</td>
<td>1110</td>
<td>179</td>
<td>16.1</td>
<td>412</td>
</tr>
<tr>
<td>Resident birds</td>
<td>1417</td>
<td>15</td>
<td>1.1</td>
<td>510</td>
</tr>
<tr>
<td>Migratory birds</td>
<td>1540</td>
<td>21</td>
<td>1.4</td>
<td>733</td>
</tr>
</tbody>
</table>

ELISA: enzyme-linked immunosorbent assay
RT-PCR: reverse-transcriptase polymerase chain reaction

Source: A. C. Stoops/NAMRU-2
HPAI Endemic Regions in Indonesia

Source: E. Sawitri/Indonesian MoA
NAMRU-2 Bird Surveillance Sites on Java
Buffer zones can be established to limit the spread of H5N1 around wetlands and the nearby farmlands.

EU’s & UK’s Practice:

- 3 km protection zone
- 10 km surveillance zone
- Larger restricted zone

ASTER image showing NAMRU-2 bird surveillance site around Muara cimanuk estuar
Poultry Outbreaks, Human Cases, Wet Markets, And Distribution Centers in Greater Jakarta

January – February 2006

richard.kiang@nasa.gov
Distance From Where Outbreaks Occurred

- **Primary road**
  - Distance to primary road (m):
    - 1000: 20
    - 2000: 15
    - 3000: 10
    - 4000: 5
    - 5000: 1
    - 6000: 0
    - 7000: 0
    - More: 0
  - Distance from outbreak to primary road:
    - 1000 to 2000 m: 15
    - 2000 to 3000 m: 10
    - 3000 to 4000 m: 5
    - 4000 to 5000 m: 1
    - 5000 to 6000 m: 0
    - 6000 to 7000 m: 0
    - More: 0

- **Secondary road**
  - Distance to secondary road (m):
    - 100: 20
    - 200: 15
    - 300: 10
    - 400: 5
    - 500: 1
    - 600: 0
    - 700: 0
    - 800: 0
    - 900: 0
    - 1000: 0
    - 1100: 0
  - Distance from outbreak to secondary road:
    - 100 to 200 m: 15
    - 200 to 300 m: 10
    - 300 to 400 m: 5
    - 400 to 500 m: 1
    - 500 to 600 m: 0
    - 600 to 700 m: 0
    - 700 to 800 m: 0
    - 800 to 900 m: 0
    - 900 to 1000 m: 0
    - 1000 to 1100 m: 0
    - More: 0

- **Wetmarket**
  - Distance to wet market (m):
    - 1000: 20
    - 2000: 15
    - 3000: 10
    - 4000: 5
    - 5000: 1
    - 6000: 0
    - 7000: 0
    - More: 0
  - Distance from outbreak to wet market:
    - 1000 to 2000 m: 15
    - 2000 to 3000 m: 10
    - 3000 to 4000 m: 5
    - 4000 to 5000 m: 1
    - 5000 to 6000 m: 0
    - 6000 to 7000 m: 0
    - More: 0

- **Distribution center**
  - Distance to distribution center (m):
    - 2000: 20
    - 4000: 15
    - 6000: 10
    - 8000: 5
    - 10000: 1
    - More: 0
  - Distance from outbreak to distribution center:
    - 2000 to 4000 m: 15
    - 4000 to 6000 m: 10
    - 6000 to 8000 m: 5
    - 8000 to 10000 m: 1
    - More: 0

- **River**
  - Distance to river (m):
    - 500: 40
    - 1000: 30
    - 1500: 20
    - 2000: 10
    - 2500: 5
    - More: 0
  - Distance from outbreak to river:
    - 500 to 1000 m: 30
    - 1000 to 1500 m: 20
    - 1500 to 2000 m: 10
    - 2000 to 2500 m: 5
    - More: 0

- **Water body**
  - Distance to water body (m):
    - 500: 20
    - 1000: 15
    - 1500: 10
    - 2000: 5
    - 2500: 1
    - 3000: 0
    - More: 0
  - Distance from outbreak to water body:
    - 500 to 1000 m: 15
    - 1000 to 1500 m: 10
    - 1500 to 2000 m: 5
    - 2000 to 2500 m: 1
    - 3000 to More: 0
Human & Poultry Cases vs. Meteorological Parameters in Greater Jakarta
Densely Populated Sector I
Poultry Production Area Near Jakarta
Poultry Farms, Markets & Traders in Sukabumi District

SUKABUMI DISTRICT
- Breeder Farm
- Broiler Farm
- Layer Farm
- Market
- Traders
- Sub-district

4200 km²
342 broiler farms
500-160,000 chickens/farm
14 wetmarkets
Factors influencing Biosecurity

Poultry Flock / House

- Wild birds
- Rodents
- Insects
- Dogs, Cats

- Litter (e.g. sawdust)
- Feed
- Water
- Air (ventilation)
- Medication

- Day-old chicks from hatcheries
- Birds from other sources
- Other birds

- Humans
- Vehicles
- Equipment

Source: O. Thieme/FAO
SEIR Compartmental Model for Simulating H5N1 Transmission in Each Poultry Farm
Markov Chain Monte Carlo Method
For Simulating Between-Farm Transmission

Farms with at least one infectious chicken

Source of infection
Asymptomatic infected chickens may be sold to unaware customers at markets.
Novel Swine Influenza Virus Reassortants in Pigs, China

Yuhai Bi,1 Guanghua Fu,1 Jing Chen,1 Jinshan Peng, Yipeng Sun, Jingjing Wang, Juan Pu, Yi Zhang, Huijie Gao, Guangpeng Ma, Fulin Tian, Ian H. Brown, and Jinhua Liu

During swine influenza virus surveillance in pigs in China during 2006–2009, we isolated subtypes H1N1, H1N2, and H3N2 and found novel reassortment between contemporary swine and avian panzootic viruses. These reassortment events raise concern about generation of novel viruses in pigs, which could have pandemic potential.
THANK YOU