

# Radio Frequency Pasteurization of Shell Eggs through the Development of Commercial Prototypes of Continuous Equipment for Multiple Eggs

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# 2018 *Salmonella* Outbreaks

- Two multistate outbreaks caused by *S. Braenderup* and *S. Enteritidis*
- 89 reported illnesses and 23 hospitalizations
- 200 million eggs recalled

[www.cdc.gov/salmonella/braenderup-04-18/index.html](http://www.cdc.gov/salmonella/braenderup-04-18/index.html)

[www.cdc.gov/salmonella/enteritidis-09-18/index.html](http://www.cdc.gov/salmonella/enteritidis-09-18/index.html)

# Need for Intervention

- If all U.S. eggs were pasteurized, the annual number of illnesses would be reduced by 85%.

(Schroeder et al. 2006)

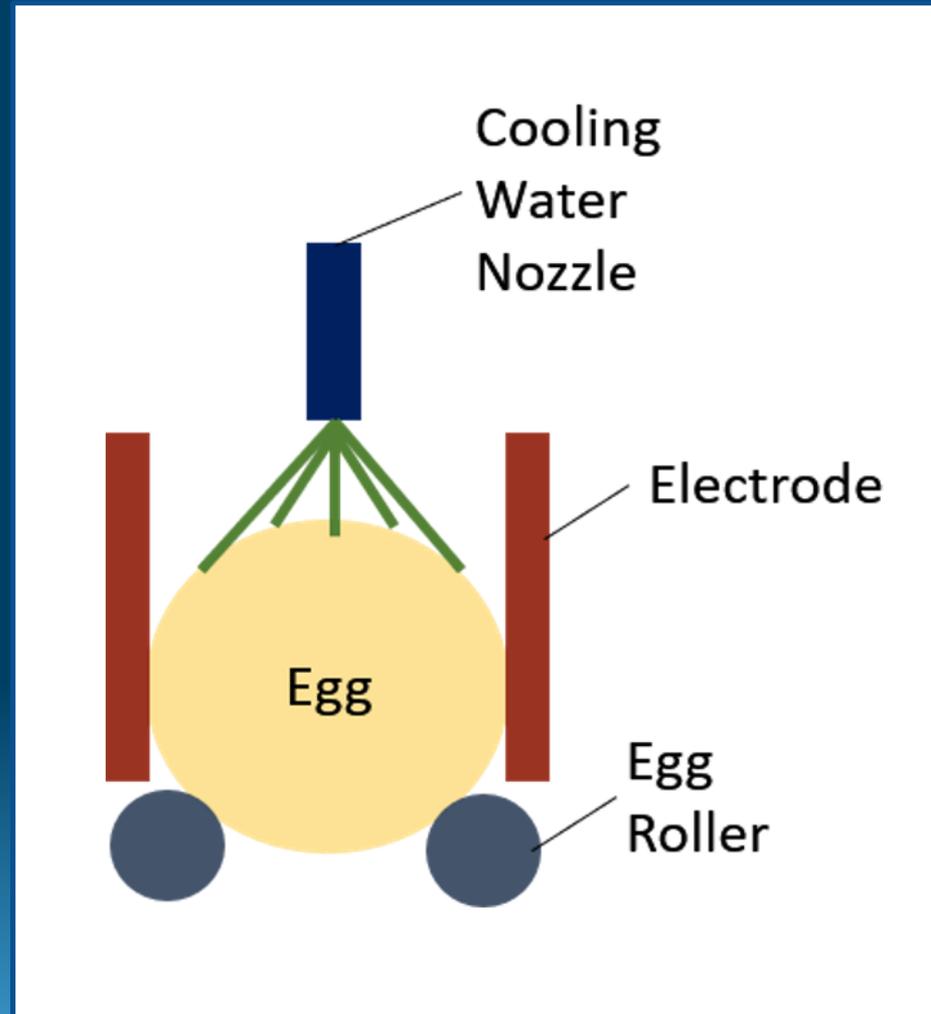
- Presently, only 3% of eggs are pasteurized, due to cost and quality

# Commercial Process- 60 Min. Hot Water Immersion



courtesy National Pasteurized Eggs

# RF Heating Apparatus



# Prototype RF Apparatus



# Albumen Appearance



Photo by J. Sites

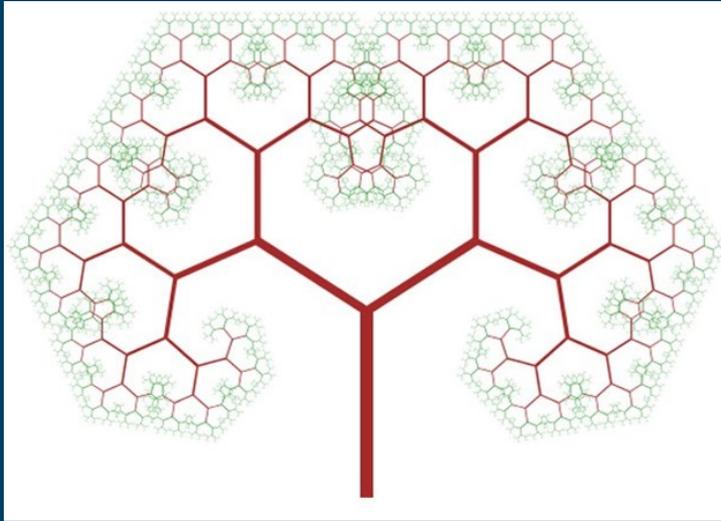
# Scale-Up

- Designed and assembled 4-egg unit
- Designed and assembled 24-egg unit

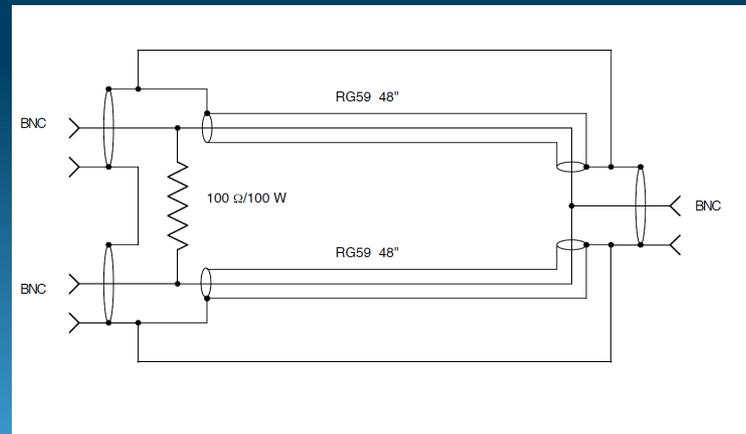


Photo by J. Sites and P. Greb

# Splitting RF Power

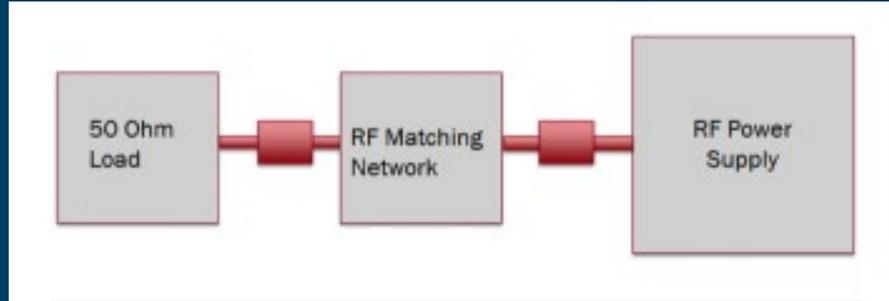


- Designed and tested 2-way and 9-way splitters
- Designed 25-way splitter



# Matching and Frequency

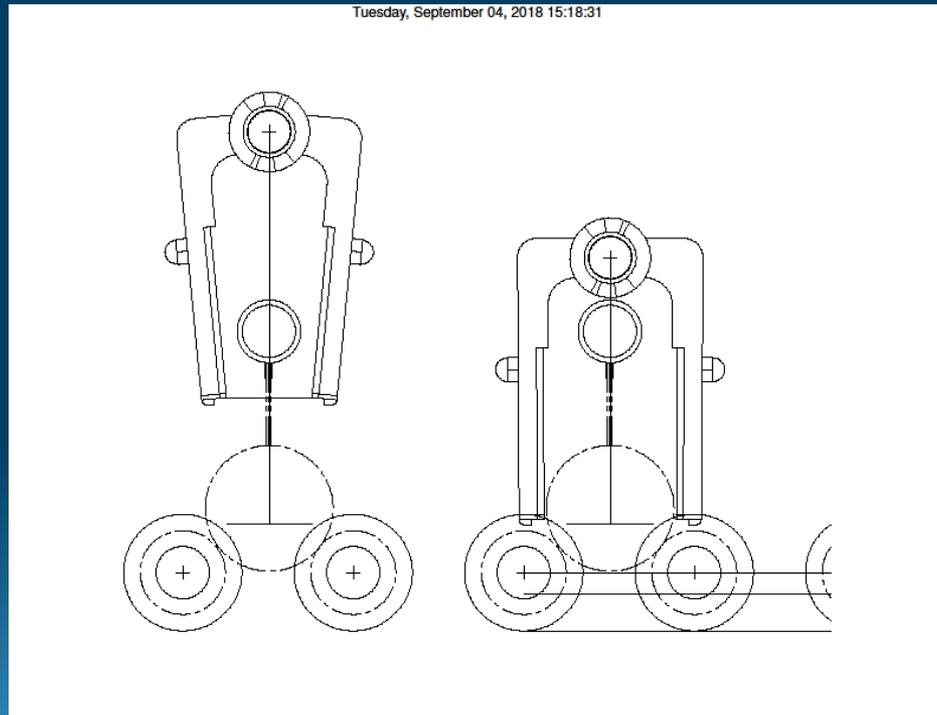
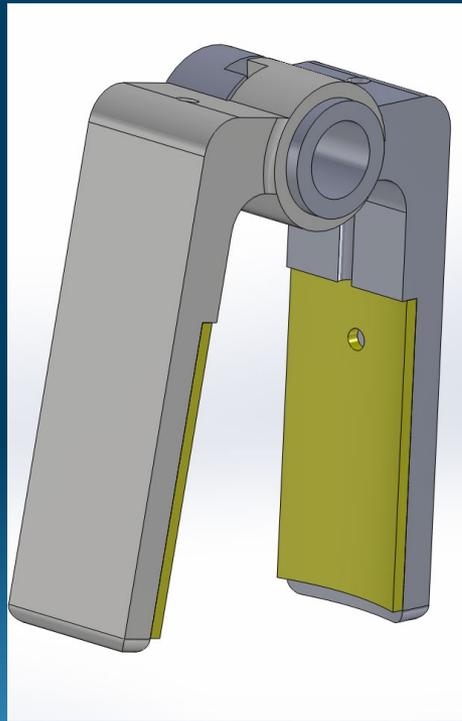
- Designed and tested matching network



- Modified network to run at 40.68 MHz, a reserved ISM frequency

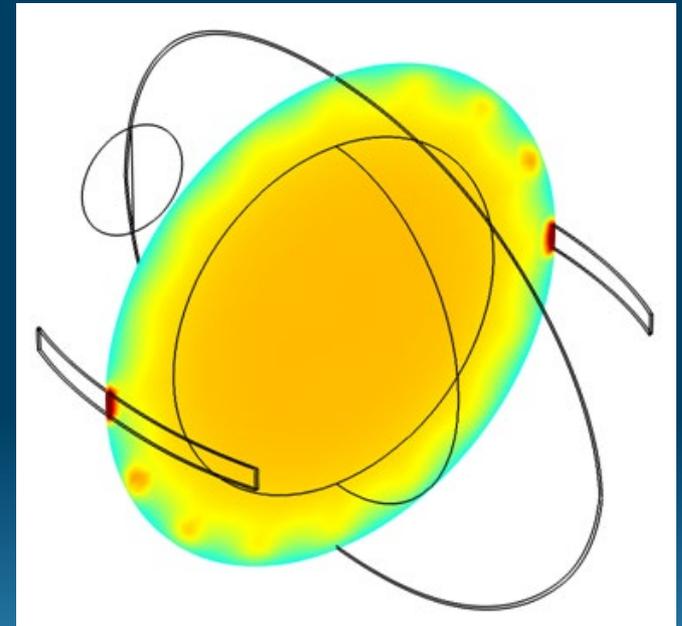
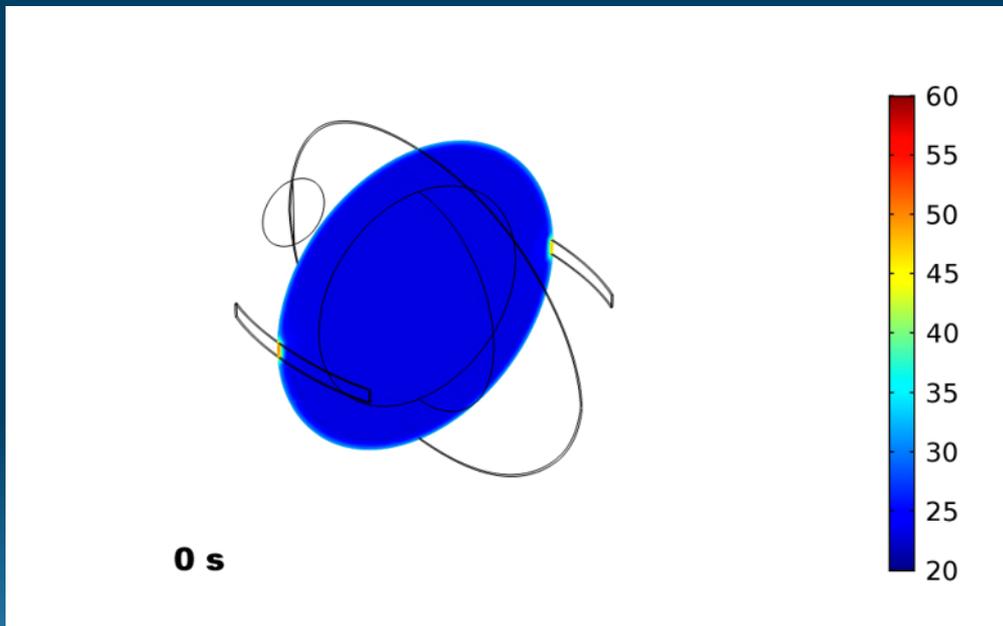
# Electrodes

- Designed and tested plate electrodes



# Modeling

- Modeled RF heating



# Hot Water Spraying

- Designed and assembled a hot water sprayer

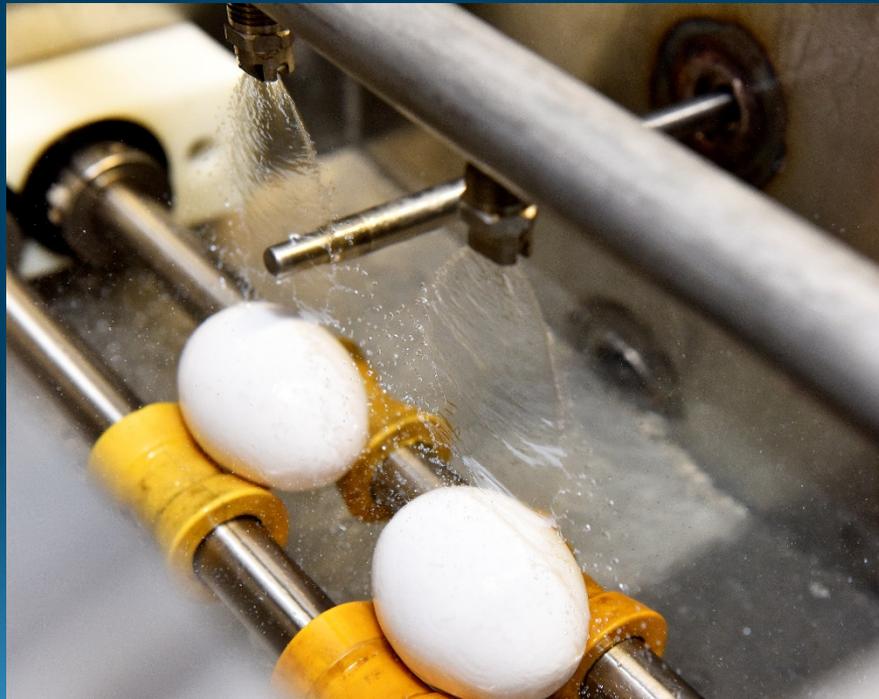
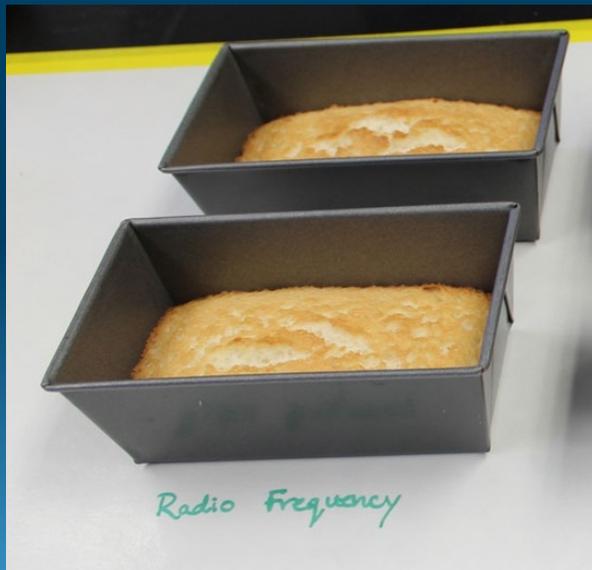


Photo by J. Sites

# RF Patents and Publications

- US Patents 8,973,492, 2015 and 9,883,682, 2018
- Pubs on microbial inactivation and quality

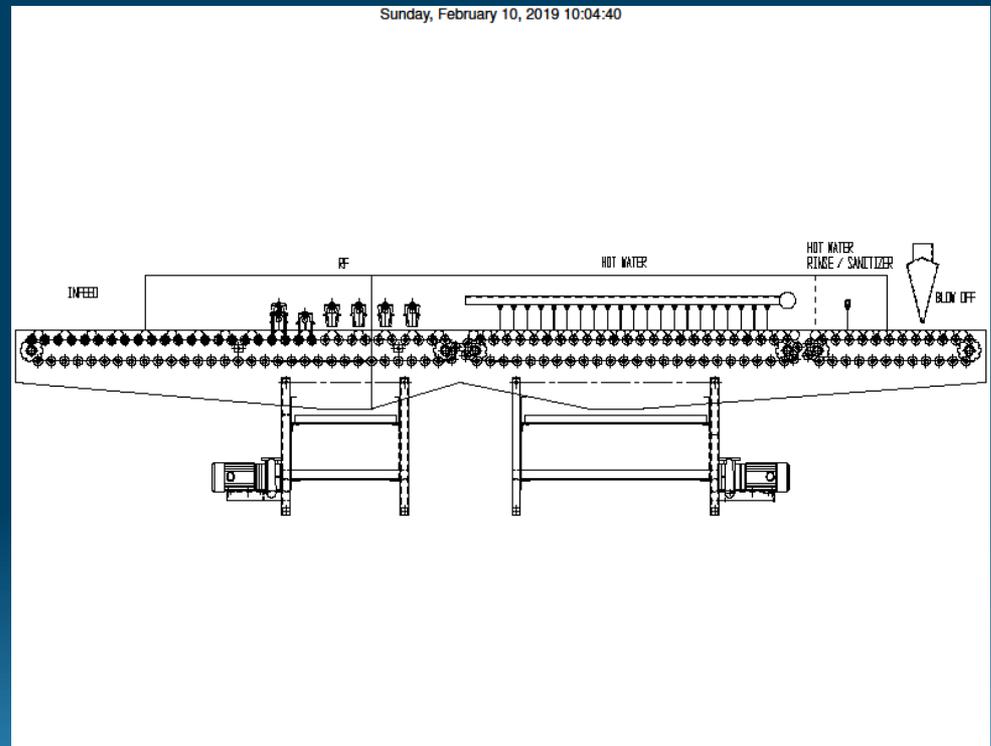
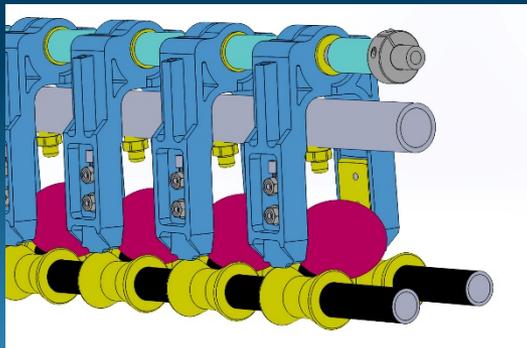
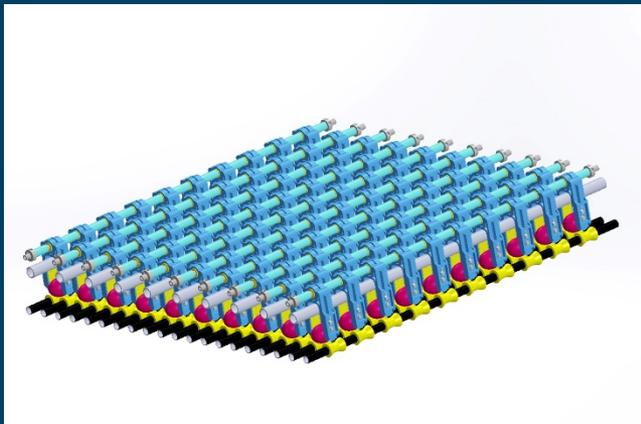


# Cooperative Research and Development Agreement with Kuhl Corp.



# Future Plans

Scale-up to continuous, commercial prototype



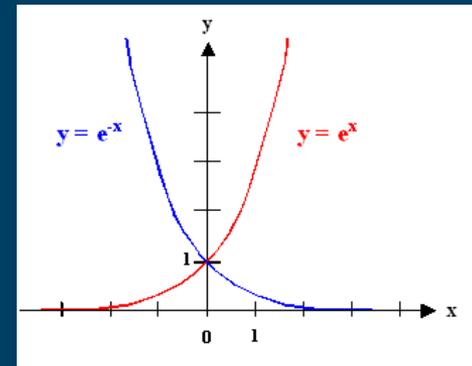
# Future Plans

- Exhibit at the 2020 International Production & Processing Expo

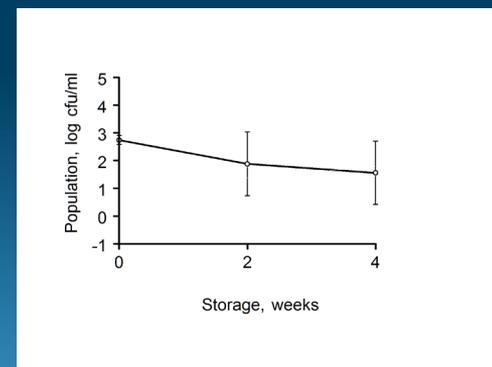


# Future Plans

- Improve efficiency



- Obtain FDA approval



# Acknowledgements

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- Mr. Kiat Lau (University of Nebraska-Lincoln)
- Dr. Joshua Gurtler (ARS - ERRC)