

Investigation of Charcoal Production Methods for Sajalices



THE MANGROVE CHARCOAL SUSTAINABILITY ENGINEERS FOR SAJALICES

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IDESIGN

Michigan Technological University

December 9, 2010

Outline



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- Introduction
- Methods and Procedures
- Analysis and Design Options
- MCSES Recommended Design
- Recommendations



Introduction



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- Sajalices & El Espavé, Panama
- IDesign- August 2010
- D80 Conference
- Charcoal Importance
- Organizations
 - DEUMSA
 - ANAM
 - UN



Methods and Procedures



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- Interviewed local workers
 - Charcoal production methods
 - Improvements desired



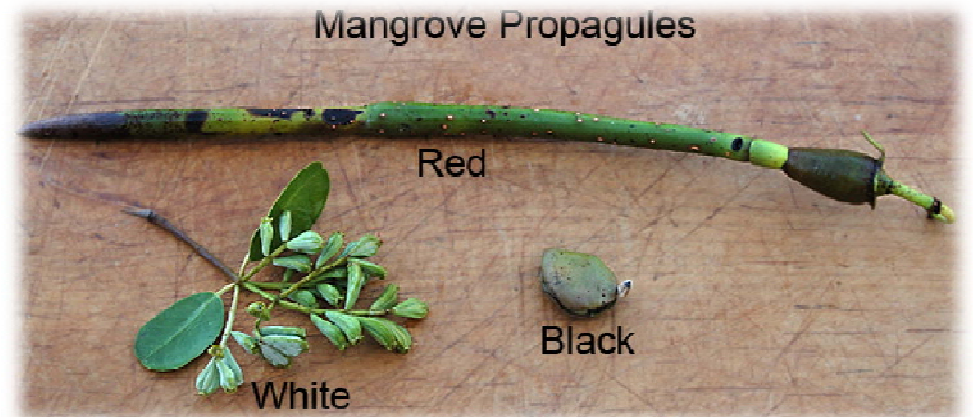
- Collected data
 - Dimensions
 - Temperatures
 - Smoke density

Methods and Procedures

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- Researched mangrove forest
 - ▣ important ecosystem
 - ▣ composition of wood

- ABC Harvesting Method
 - ▣ A: Mother Trees
 - ▣ B: Immature Trees
 - ▣ C: Mature/Sickly Trees



Methods and Procedures



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Traditional Method



Japanese Oven (personal)

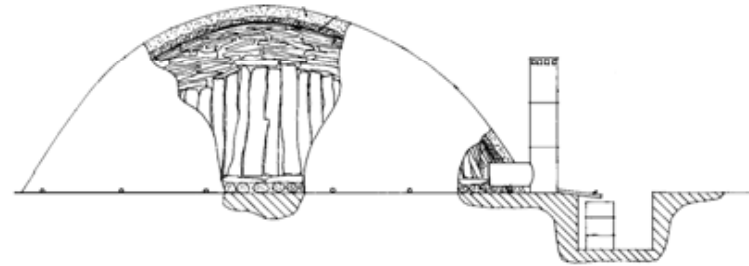


Analysis and Design Options

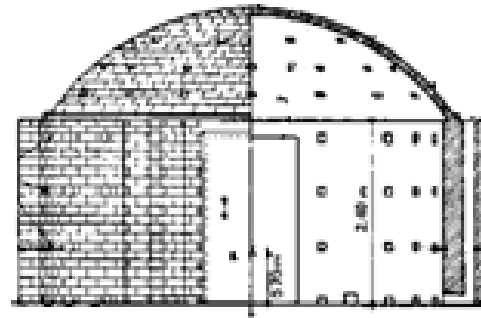


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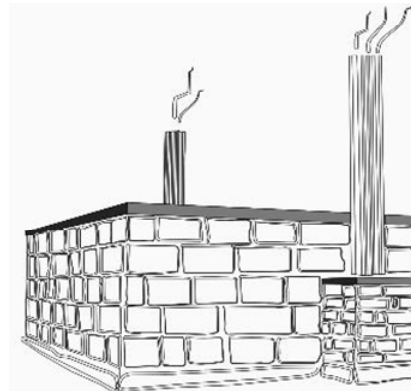
- Casamance Kiln



- Brazilian Beehive



- Retort Kiln



Criteria for Design



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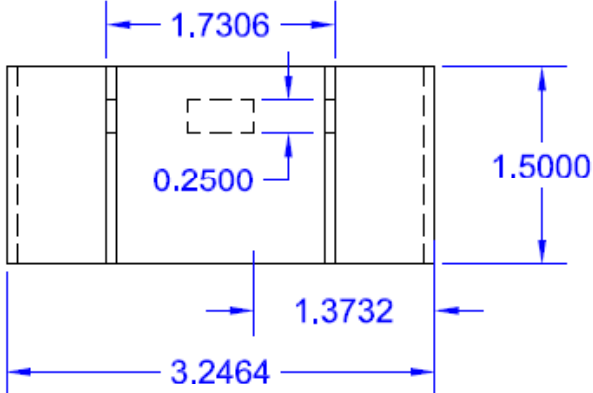
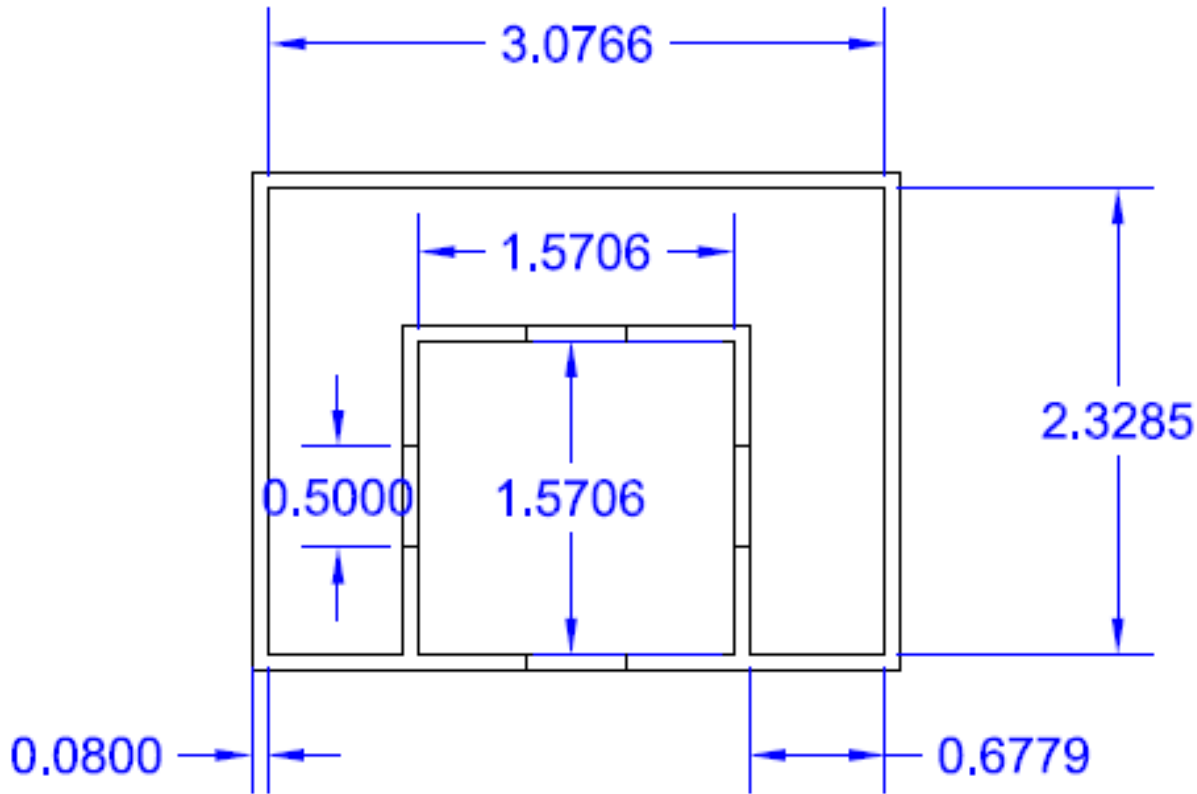
- Design a system
 - For the commercial production of charcoal
- Criteria
 - Durable
 - Protect and maintain the mangroves
 - Optimize the design
 - low cost and high efficiency
 - Reduce harmful emissions
 - Protect health of workers

MCSES Recommended Design

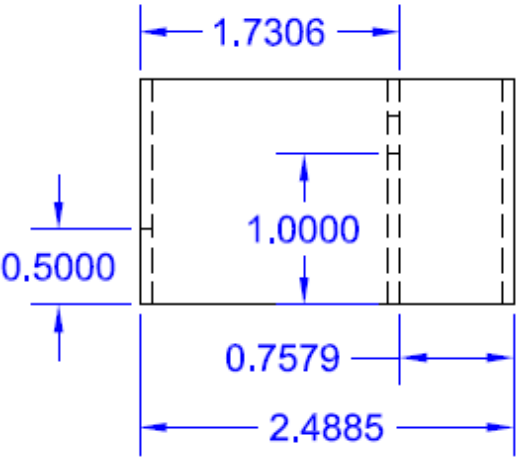


TOP

FRONT



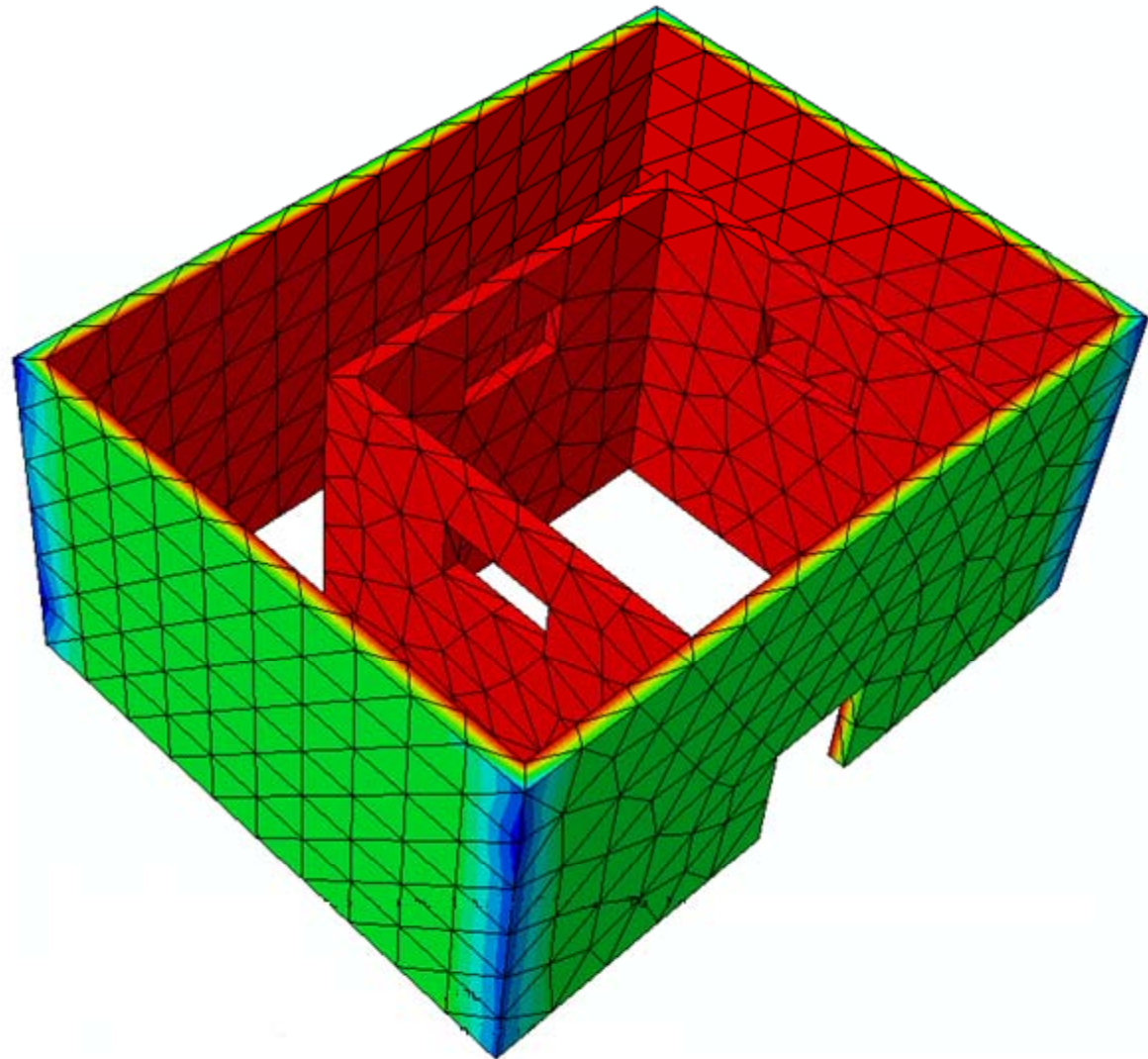
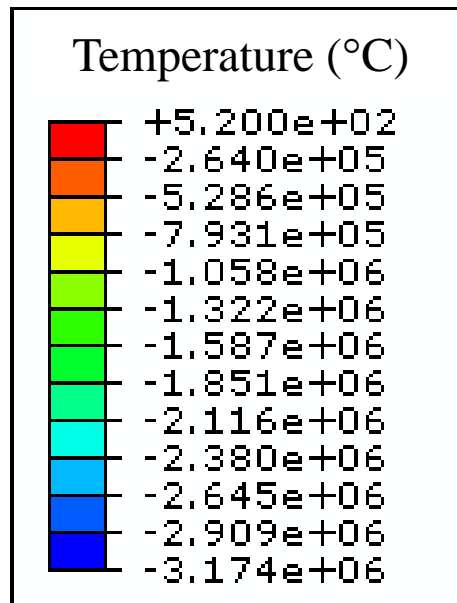
RIGHT



Unit: METERS

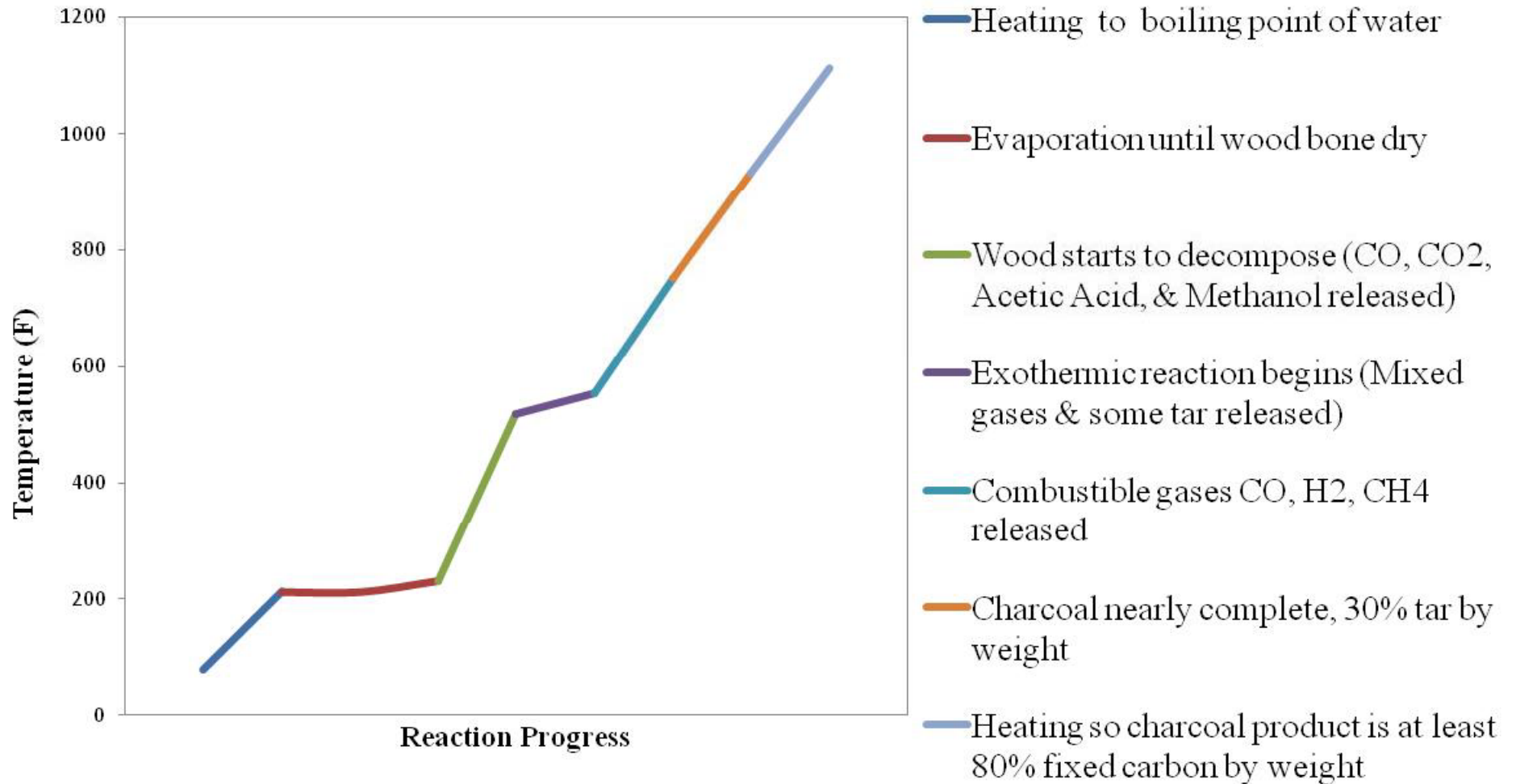
MCSES Design

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Pyrolysis (Charcoal Production Process)

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Construction Schedule

Construction Schedule					
Activity	Description	Details	Duration (hours)	Work Days Required	Prerequisite Activities
1	Prepare oven location	Level the ground, remove rocks, roots, trees, etc., compact earth to keep bricks from sinking	16	2	0
2	Collect materials	Order bricks, sheet metal, metal piping, mortar, grating sheet, fume hood (distillation device)	168	7	0
3	Lay outline of oven	Ensure correct sizing and brick placement for firebox and pyrolysis chamber	8	1	1, 2
4	Build oven walls	Ensure correct heights	32	4	3
5	Add grating level	Keeps wood off ground, giving space for ash to fall	1	0.125	4
6	Attach chimneys	Allows for ventilation of gases	3	0.125	4
7	Begin charcoal process	-	-	-	5, 6
Total:			228 hours	14.25 days	

Cost Analysis



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Construction Cost

	Items	Cost
Materials	Fire brick	\$1,466.00
	Metal plate	\$600.00
	Screen	\$208.00
	Bamboo	\$1.00
	Chimney tube	\$3.00
	Bell cone	\$96.00
	Wire	\$1.00
	Total:	\$2,375.00
Tools	Shovels	\$12.00
	Measuring tape	\$4.00
	Bucket/ wheelbarrow	\$40.00
	Trowels & wooden	\$6.00
	Total:	\$61.00

TOTAL COST: \$2,436.00

Cost Analysis

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Profit Analysis

	Components	Amount
Cost (\$/c-year)	Fuel wood	\$0.00
	Labor	\$0.00
	Boat & tool motor fuel	\$5,286.00
	Transport to market	\$1,000.00
	Total (\$/c-year):	\$6,286.00
Revenue	Bags produced per batch	40
	Batch time (hrs)	42
	Service factor	0.8
	Operation (wks)	41.6
	Bags produced per year	6656
	Charcoal per yr (lb/c-year)	232960
	Cost per bag (\$/bag)	2.5
	Total (\$/c-year):	\$16,640.00
	Contingency costs (at 10%)	\$629.00
TOTAL PROFIT:		\$9,725.00

Conclusions

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Criteria

1. System for commercial production of charcoal
2. Durable
3. Low cost
4. High efficiency
5. Reduce harmful emissions
6. Protect health of workers

1. Protect and maintain the mangroves

Solution

- ✓ MCSES Design
- ✓ Fire bricks, square design, easily repairable
- ✓ \$2,436 (3 mo. payback period)
- ✓ 232960 lbs per year
- ✓ Recycle process
- ✓ Chimney to direct smoke, no exposed flame
- ✓ Continue ABC harvesting and replant

Recommendations

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- ❑ Shelter built to protect design
- ❑ Clean ash from chambers
- ❑ Build design in ground to help insulate
- ❑ Dry mangrove wood to shorten batch time
- ❑ Perform experimental trials of the design



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Disclaimer

The calculations involved were done in an idealistic manner and certain information was substituted based off availability.

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Acknowledgements



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- **ANAM:**

- Lic. Cesar Paniagua, Octauio Dela Cruzs, Tadao Shimada

- **DEUMSA:**

- Alcibiades Rodriguez, Amado, Amaria Geosta, Eraclio, Felipa Guardia, Juan, Mara Barria, Na' Akim, Yamisel Medina

- **UN:**

- Armando Diez, Jose Manuel Porez, Lourdes Lozano

- **MTU:**

- Dr. Blair Orr, Dr. Charles Margraves, Dr. David Shonnard, Dr. David Watkins, Kelli Whelan, Dr. Michael Mullins, Mr. Mike Drewyor, Dr. Thomas Clancey, Dr. Tony Rogers