NASA Marshall Space Flight Center

Undergraduate Student Research Program (USRP)

Intern Presentations Spring 2010

Wednesday, April 28, 2010

Bldg. 4205, Room 112E/F

GFSSP IN ER-43

Keon Hawthorne

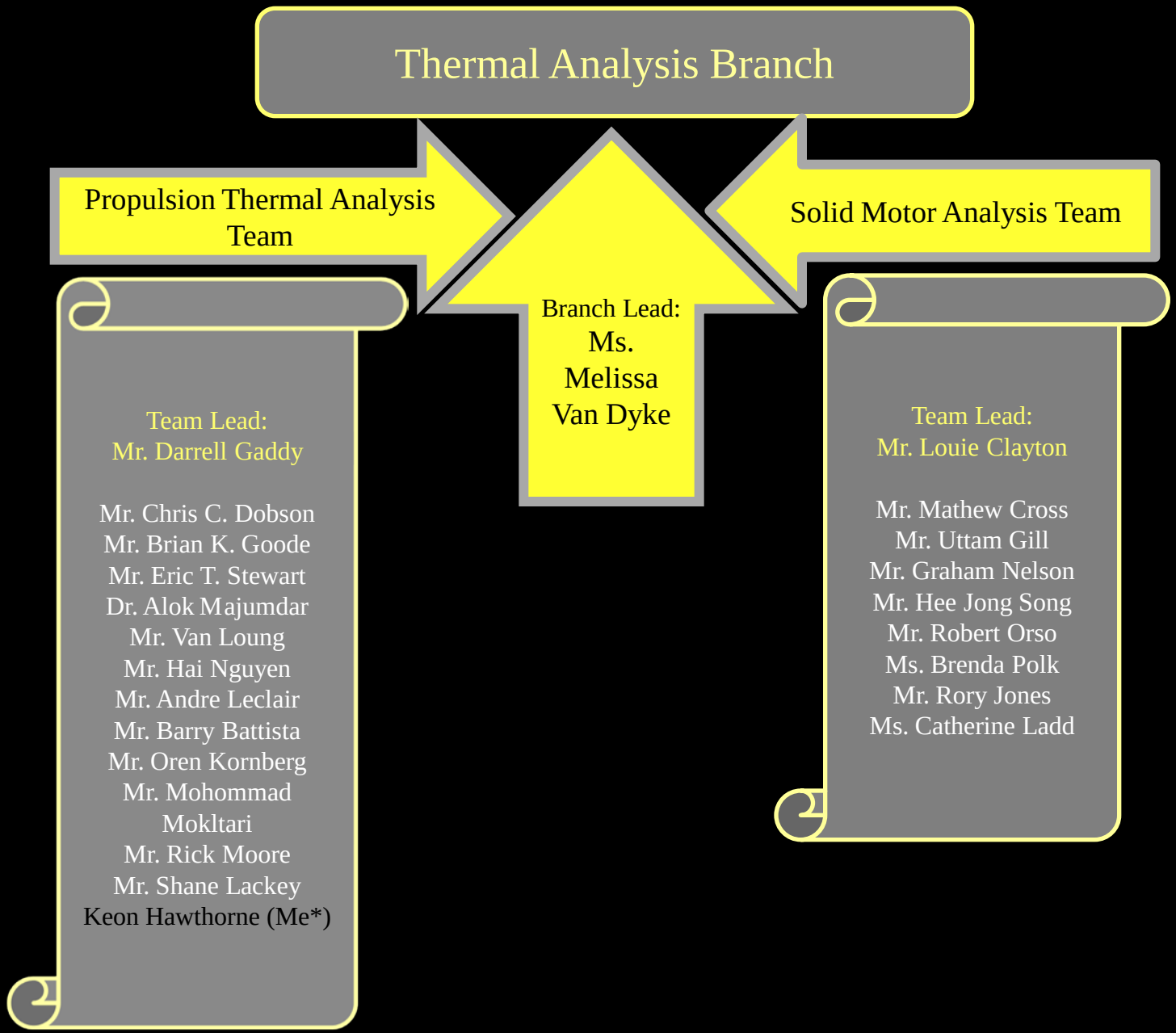
About the Presenter

- From Memphis
- Attend Alabama A&M University
- Fitness & Sports Enthusiast
- Noted for my apparel choice

Agenda

- Introduction to ER-43
- Overview of GFFSP
- Validation of GFSSP
- Additional Assignments and tasks
- Valuable experience received

ER-43


Thermal Analysis Branch
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Solid Motor Analysis Team
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Mr. Chris C. Dobson
Mr. Brian K. Goode
Mr. Eric T. Stewart
Dr. Alok Majumdar
Mr. Van Loung
Mr. Hai Nguyen
Mr. Andre Leclair
Mr. Barry Battista
Mr. Oren Kornberg
Mr. Mohommad Mokltari
Mr. Rick Moore
Mr. Shane Lackey
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Team Lead:
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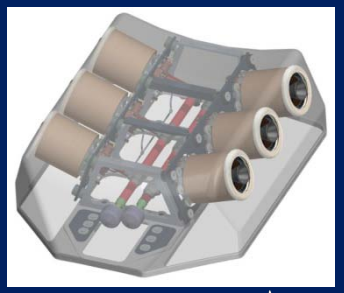
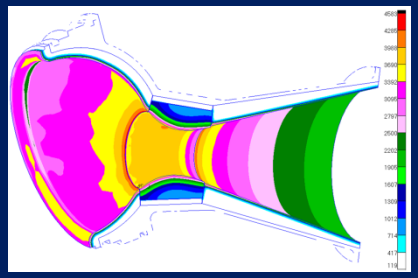
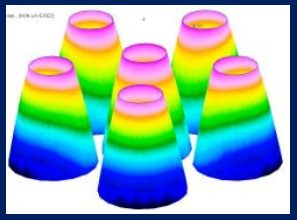
Mr. Mathew Cross
Mr. Uttam Gill
Mr. Graham Nelson
Mr. Hee Jong Song
Mr. Robert Orso
Ms. Brenda Polk
Mr. Rory Jones
Ms. Catherine Ladd

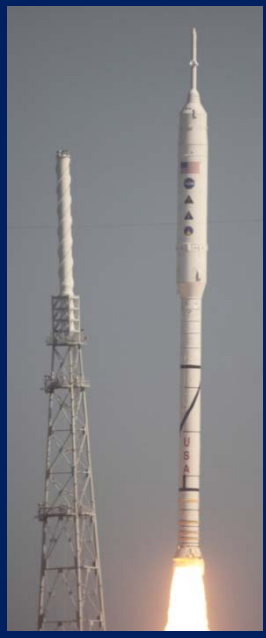
ER-43 Projects

- Shuttle SSME Operations
- Shuttle RSRB Operations
- Shuttle External Tank Production
- Shuttle PSE&I – MPS
- Ares First Stage Booster - RSRMV and BDM/BTM
- Ares 1-X First Stage Booster
- Ares -J2-X
  - Engine Systems Hardware
  - Systems Engineering
  - Valves & Actuators. Controls, ECU, etc..
  - Instrumentation
  - Turbopumps
  - Turbine Drive & Injectors (GG)
  - Main Combustion Chamber
  - Nozzle
- CLV US - MPS
  - LOX
  - LH2
  - MPS
- CLV US - Ullage Settling Motor
- CLV - RCS
  - ReCS
  - RoCS
- CLV Launch Abort System LAS
- PCAD Aerojet Ascent Main Engine
- CECE
- Pintle
- KSC – Launch Services - GFSSP Task
- Service Module
- Ares V RS68 study
- LSAM
- ILN









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Slide Information, Layout and Pictures: Melissa VanDyke and ER-43 *

The Acronym

History of GFSSP

- Made an Official project in March of 1994
- First Version Released in October of 1997
- Version 3.0 Received NASA Software Award in 2001
- Conjugate Heat Transfer was introduced in version 5.0

Developers and Contributors of GFSSP

- GFSSP: Dr. Alok Majumdar*
- Ric Moore/MSFC *
- Katherine VanHooser/MSFC*
- Kimberly Holt/MSFC
- Paul Schallhorn/KSC
- Todd Steadman/MSFC*
- John Bailey/Jakobs
- VTASC: Saif Warsi/ERC

* Worked with or met on center

Amazing Abilities of GFSSP

- Multiple resistance options
- Numerous amount of fluids
- Calculates a variety of measurements
- Saves Money

(est. $825,000 to $1,545,900)

Dr. Alok NASA software of the year presentation

In 2001

Version 5.06 vs. Version 6.01

$$2042.64\ seconds * \frac{1\ minute}{60\ seconds} = 34.044\ minutes$$

Version 5.06

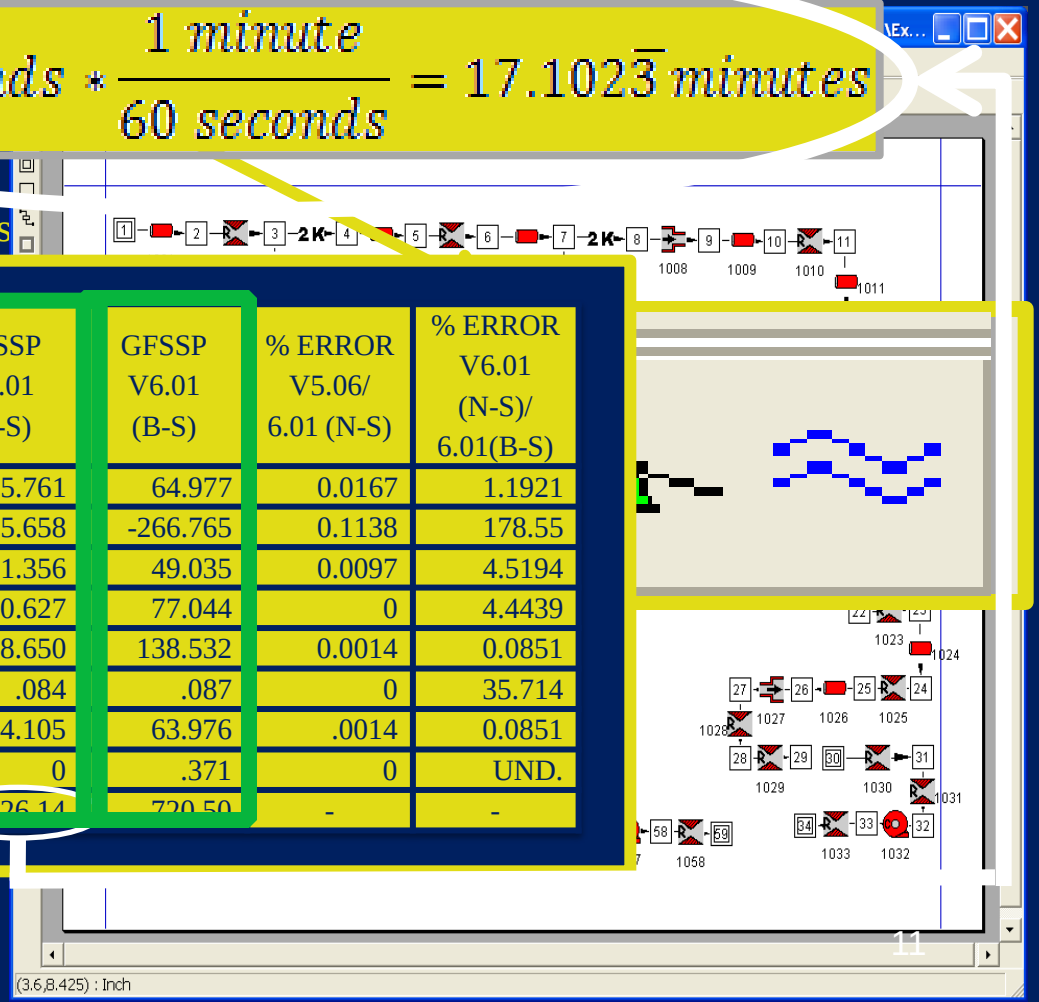
- Multiple S
- Shortcut Bar

Version 6.01

$$1026.14\ seconds * \frac{1\ minute}{60\ seconds} = 17.102\overline{3}\ minutes$$

Table Example 12 Chosen Comparison Parameters

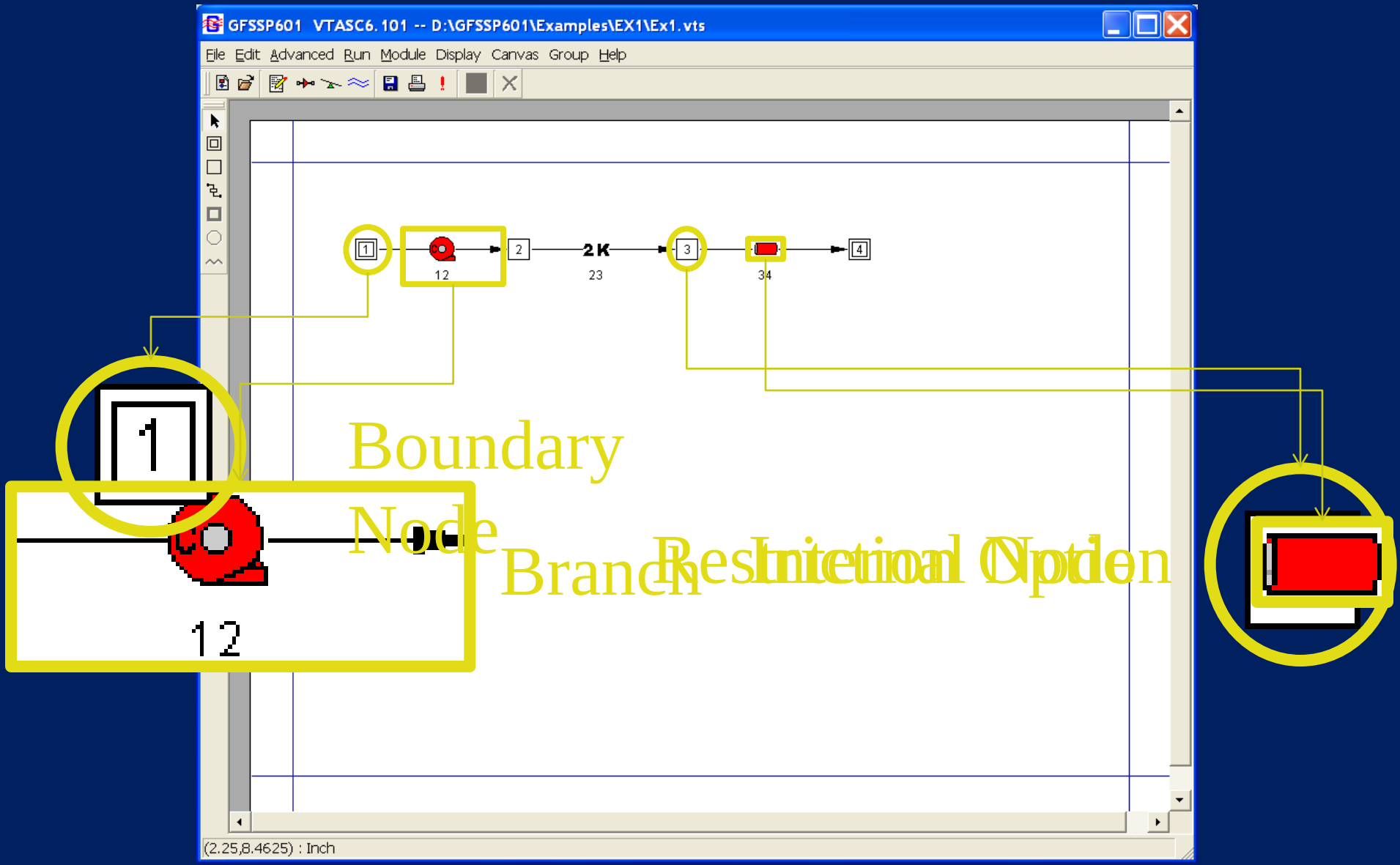
Chosen Testable Parameters	GFSSP V5.06	GFSSP V6.01 (N-S)	GFSSP V6.01 (B-S)	% ERROR V5.06/ 6.01 (N-S)	% ERROR V6.01 (N-S)/ 6.01(B-S)
Pressure (PSI) node 54 {final 60.02sec}	65.750	65.761	64.977	0.0167	1.1921
Temperature (°F) node 54 {60.2 sec}	-95.767	-95.658	-266.765	0.1138	178.55
Pressure (PSI) node 29 {200 sec}	51.361	51.356	49.035	0.0097	4.5194
Temperature (°F) node 29 {200 sec}	80.627	80.627	77.044	0	4.4439
Flow Rate 1058 (LBM/Sec)	138.648	138.650	138.532	0.0014	0.0851
Flow Rate 1029 (LBM/Sec)	.084	.084	.087	0	35.714
Flow Rate 1033 (LBM/Sec)	64.106	64.105	63.976	.0014	0.0851
Flow Rate 1054 (LBM/Sec)	0	0	.371	0	UND.
Time Analysis (Sec)	2042.64	1026.14	720.50	-	-



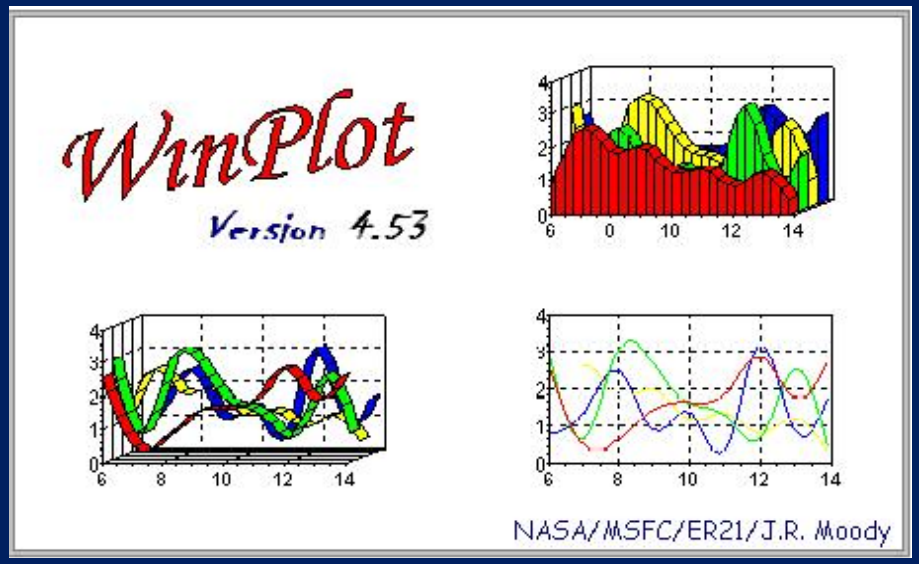
Future of GFSSP

- 2-D Models
- SI Units
- Synch with Patran/SINDA
- GFSSP still receives government funding for upgrades and improvements.

VTASC AT A GLANCE



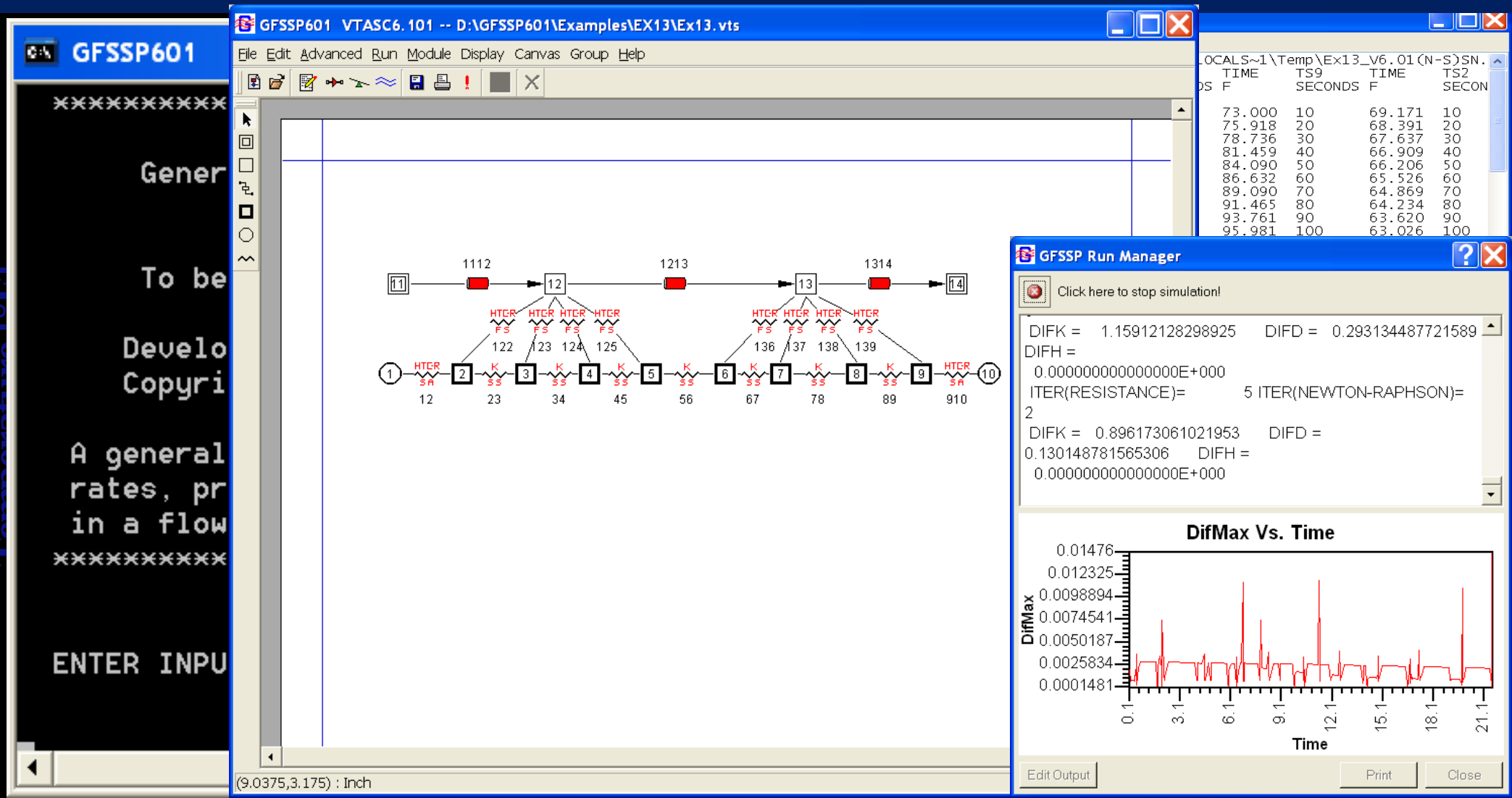
WinPlot vs. Excel



WINPLOT V4.53	POST PROCESORS	EXCEL 2007
★	DATA SPACE	
★	USER FRIENDLY	
★	ACESSIBILITY	
	APPEAL	★

Validation Order

- PRE-PROCESSOR (VTASC)
- PROCESSOR (GFSSP)
- POST-PROCESSOR (WIN-PLOT)



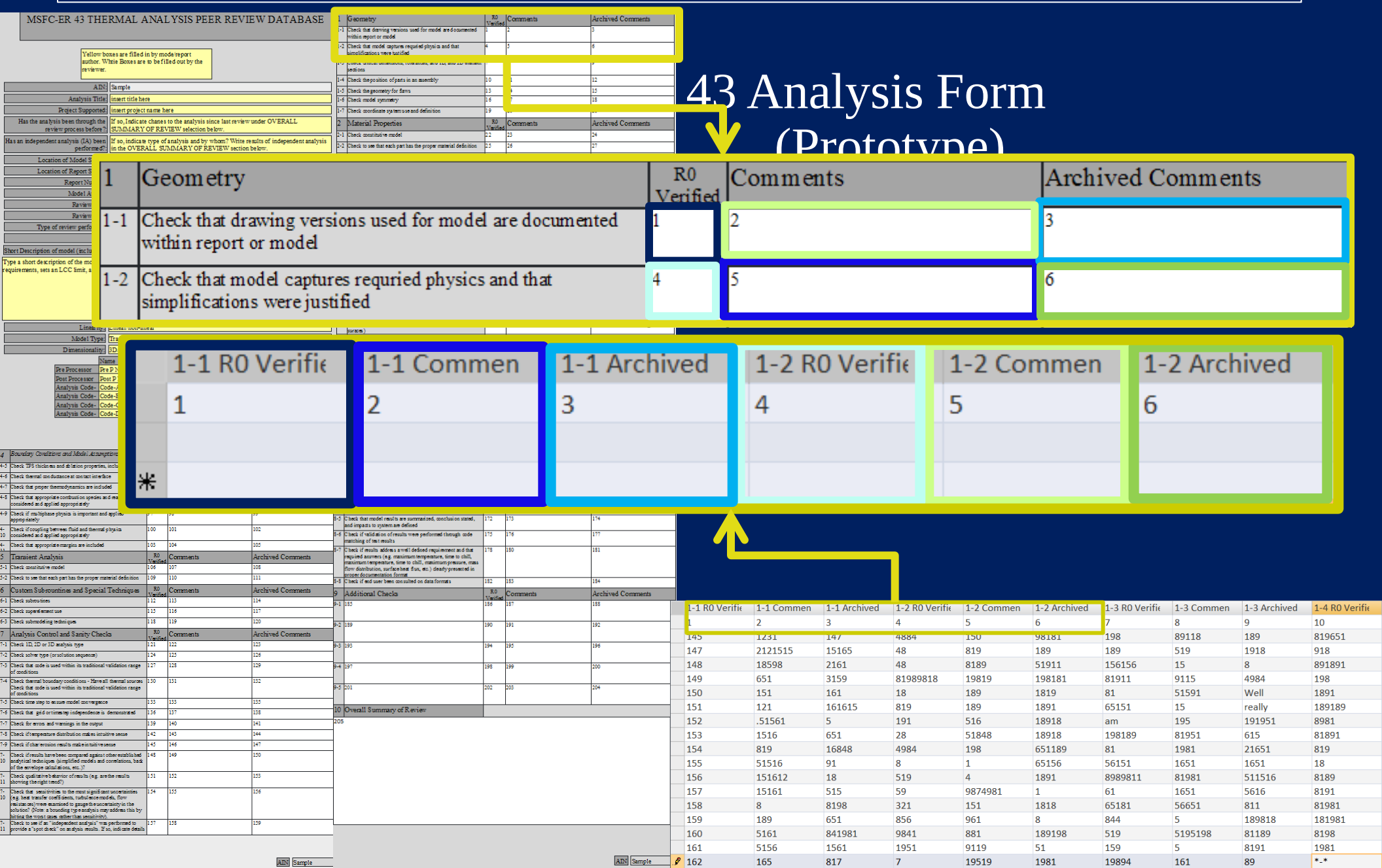
GFSSP outside of MSFC

- NASA
  - ARC
  - GSFC
  - JPL
  - KSC
  - LRC
  - GRC
  - DFRC
- Aero Space Corporation
- UAH/Computer Science Department
- Jacobs Engineering
- Los Alamos National Lab/ Applied Engineering Tech
- Barber-Nichols, Inc.
- UT-Battelle, LLC/Oak Ridge National Lab
- Jacobs Sverdrup
- Orion Propulsion Inc.
- Boeing Space & Information Systems
- Mechanical Solution Inc.
- Florida Turbine Technology
- Capstone Turbine Corp./Turbomachniery Div
- U.S. Army RDEcom
- Network Analysis Inc.
- Space Exploration Technologies Corp
- U.S. Air Force Research Lab/ Air Vehicles Directorate
- KT Engineering
- Schafer Corp.
- Alliant Techsystems, ATK GASL
- Air Force Research Lab/Liquid Rocket Engine Branch
- TGV Rockets
- United Launch Alliance
- SAIC-Huntsville, bdSystems Inc.
- QinetiQ North America
- Sierra Lobo, Inc.
- Air Launch LLC
- Bigelow Aerospace, LLC

Conclusion of Validation GFSSP 6.01

- Saved significant run time
- V6.01 Newton Solver worked well
- V6.01 Broyden solver needs a few adjustments
- GFSSP will be a significant code regardless of the future program

Secondary Assignment



Third Assignment

- PATRAN/SINDA (NASTRAN)
- Completed examples
- Recognized capabilities

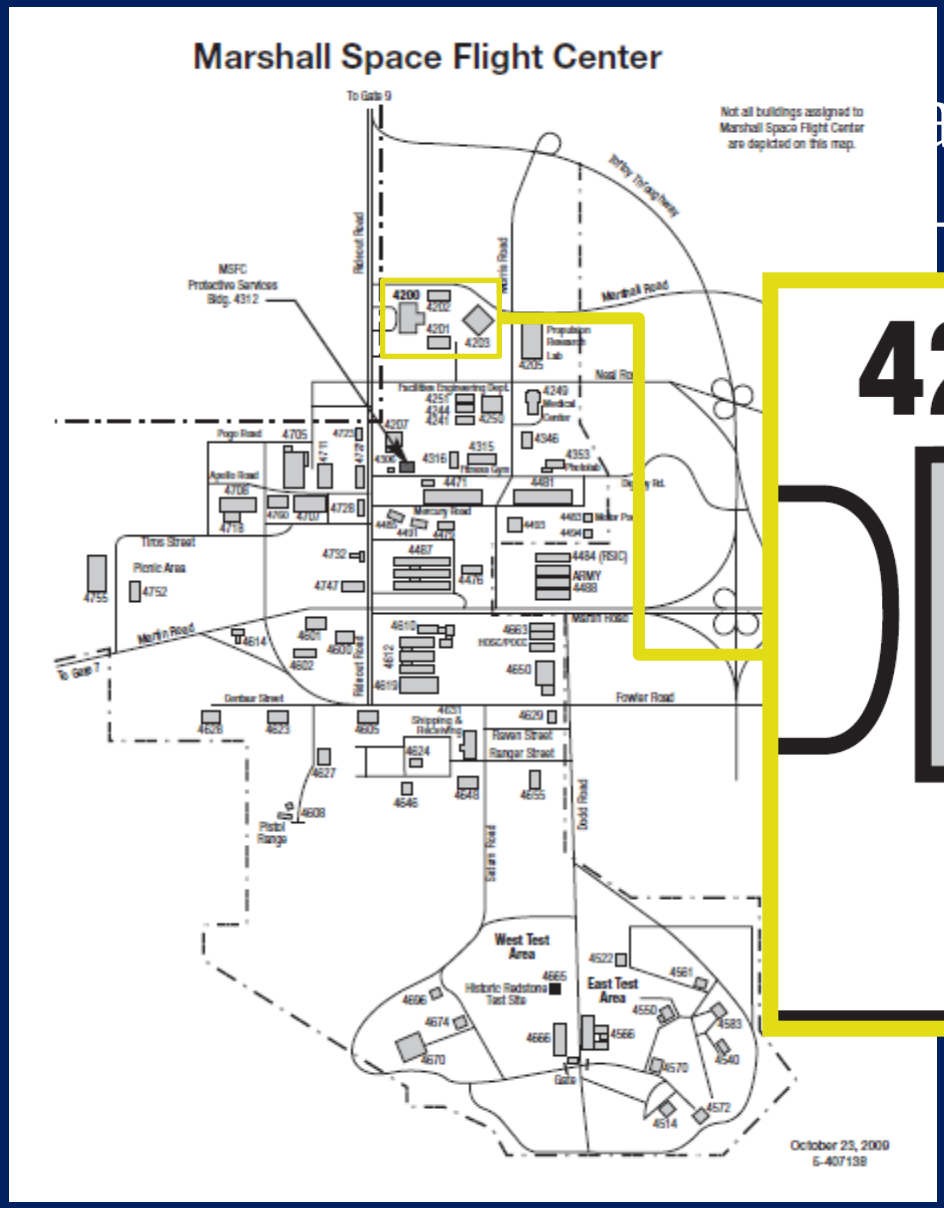
New Skills Acquired

- GFSSP V5.06 (with VTASC)
- GFSSP V6.01 (with VTASC)
- PATRAN 2008/SINDA
- WinPlot V4.53
- Microsoft Access
- Working in a Cubicle
- Networking Improved

Work Space


EXIT
3144
Brenda Polk
Presentation of Spring USRP
Work Term
DONE
FINISHED
FRANC WORK

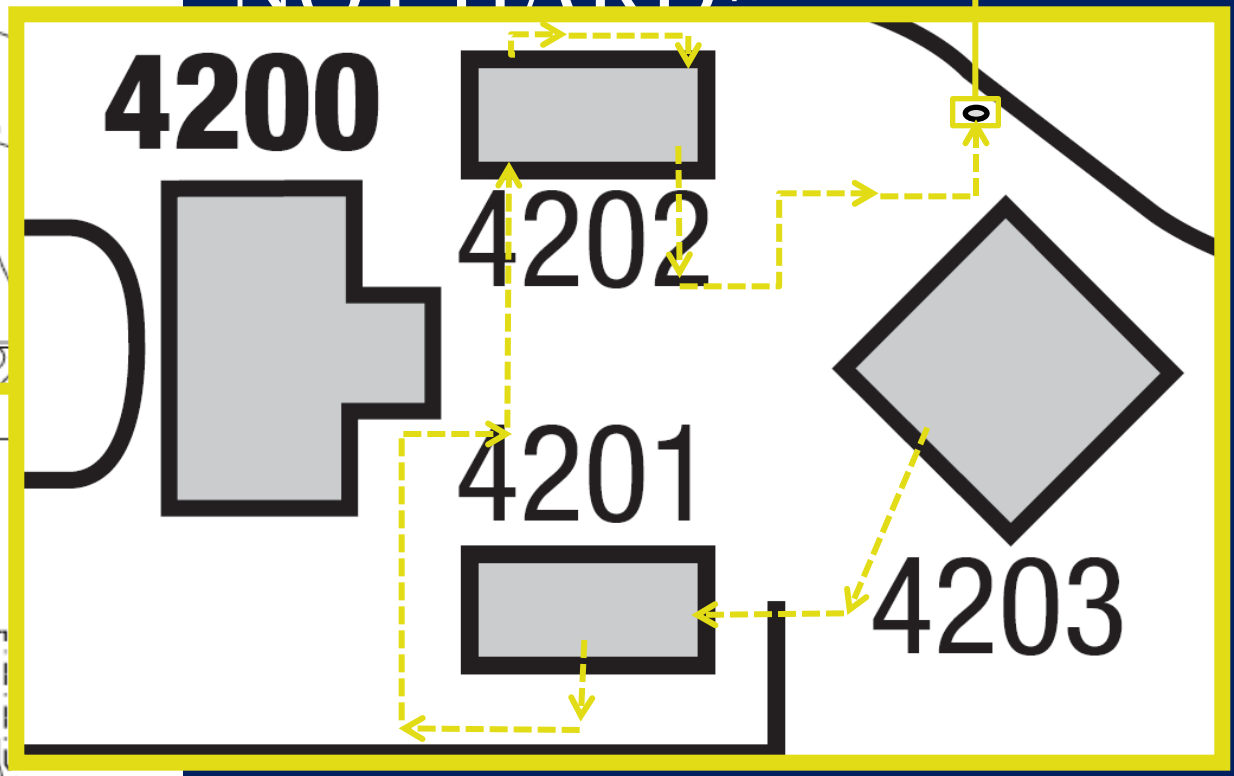
Lessons Learned



My Car…

amount of acronyms

T NOT HARD!




Huntsville/Madison County
bridges
Chamber of Commerce
HUNTSVILLE
MADISON COUNTY, ALABAMA, USA
The Sky is not the limit

LOWE MILL

ARTS & Entertainment

2211 Seminole Drive, Huntsville, AL 35805

AVIATION CHALLENGE


EXIT


Downtown
Rescue Mission
" A Heart for the Homeless "

SPECIAL THANKS

Ms. Melissa Van Dyke
Ms. Mona Miller
Ms. Carla Holloway
Dr. Alok Majumdar
Mr. Stan Tieman
Mr. Odric Moore
Mr. Michael Radden
Mr. Joe Ruf
Mr. Chris Morris
Mr. Graham Nelson
Mr. Marvin Rocker
Ms. Chrissa Hall
Mr. Uttam Gill
Ms. Shawanda Maynard
Mr. Mathew Cross
Ms. Brenda Polk
Mr. Ed Reske
Mr. Andre Leclair
Ms. Catherine Ladd
Mr. Javiher Hogan
Ms. Karla Miller
Bridges Huntsville/ Madison County
Ms. Peggye Thibodeaux
MSFC Interns and Co-ops of Spring 2010
[All TOUR GUIDES] during the internship
ALL Users of GFSSP
Anyone who has shared encouraging words to me in the gym, parking lot, elevator, or anywhere else while on Center

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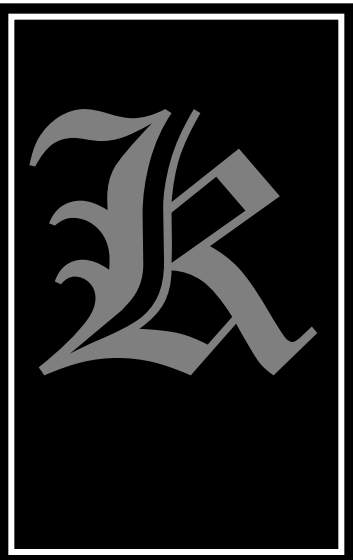

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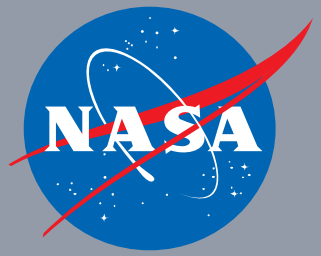
Memphis image:
http://arachnerd.files.wordpress.com/2009/04/memphis-tennessee-us_01-360a030707.jpg
Alabama A&M University:
http://www.alabamabowling.com/aamu/aamu.gif
ER-43 Information and Imagery: Melissa Van Dyke, Darryl Gaddy, Louie Clayton, and ER-43
GFSSP & VTASC imagery VTASC: Dr. Alok Majumdar, Mr. Saif Warsi, and other GFSSP developers and contributors
Winplot icon: J.R. Moody

GFSSP website

http://gfssp.msfc.nasa.gov/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