Next-generation lightweight mirror modeling software

William R. Arnold Sr., Sr. Principal Engineer, DAI, Huntsville, AL.  
Mathew Fitzgerald, NASA Intern, NASA MSFC, Huntsville, Al.  
Rubin Jaca Rosa, NASA Intern, NASA MSFC, Huntsville, Al.  
Dr. Phil Stahl, AMTD PI, NASA MSFC, Huntsville, Al.
INTRODUCTION

• The modeler was developed to handle all current and projected mirror construction techniques and materials.

• It can be used to model both individual mirrors, arrays of mirrors and “fused segmented” mirrors

• It uses a new generation of algorithms and code written for Windows 7 © and beyond

• Designed for rapid trade studies of both gross geometry as well as detailed parameter (thickness) optimization and integrated suspension design.
INTEGRATED APPROACH TO DESIGN WORKS
(PREDECESSOR PROGRAM USED ON KEPLER)

Integrated Design of Handling Equipment

Primary Mirror in Flipping Ring

Design tool allows evaluation of the mirror blank. As mirrors manufacturing requires careful design tool allows evaluation of the mirror blank. As mirrors manufacturing requires careful design tool allows evaluation of the mirror blank. As mirrors manufacturing requires careful
WIDE VARIETY OF OPTIONS TO MODEL ALMOST ANY MIRROR STYLE

SIMPLE SINGLE BLANK MIRRORS
WIDE VARIETY OF OPTIONS TO MODEL ALMOST ANY MIRROR STYLE

MULTIPLE SEGMENT MIRRORS
MANY CONFIGURATION OPTIONS ARE AVAILABLE
COMPLEX SEGMENTED ASSEMBLIES CAN BE MERGED INTO A SINGLE STRUCTURE

PRE-MERGE

POST-MERGE

JOINT GEOMETRY PRESERVED
CORE WEB THICKNESSES CAN BE VARIED THRU DEPTH

MODEL STATISTICS AVAILABLE ONCE CREATE MODEL FINISHES
INITIAL ELEMENT THICKNESS & MIRROR MATERIAL OPTIONS

Input decks can be generated for ANSYS, ABAQUS or NASTRAN.

All settings can be archived and retrieved.
AXIAL STYLE SUSPENSION
PER SEGMENT OR WHOLE MIRROR
RADIAL STYLE SUSPENSION
PER SEGMENT OR WHOLE MIRROR
TANGENT BAR SUSPENSION
PER SEGMENT OR WHOLE MIRROR
YOU CAN DEFINE LOAD CASES

STATIC, MODAL & PSD

- ANSYS: Generates analysis stream complete with plots and result files
- ABAQUS: Generates analysis stream, uses ABAQUS/CAE Python script for plots & results
- NASTRAN: Generates analysis stream, uses FEMAP or PATRAN for plots & results
IF ULE© BOULE CTE DATA AVAILABLE IT CAN BE MAPPED ONTO THE MODEL

SEGMENT ID CAN BE SHOWN ON GRID
GRID PLOTTING OPTIONS

SIMPLIFIED MESH, PAN & ZOOM, ELEMENT SHRINK
LOCALIZED MESH REFINEMENT UNDER SUPPORT PADS

BEFORE

AFTER
A LOT OF MESHING OPTIONS AVAILABLE

- Triangles
- Pocketed back sheet
- Isogrid faceplates
- Quadralaterals
- Refined front sheet
- Core fillets
CAN MODEL A PURE ISOGRID CORE [LEVEL0]
GRID COMPLEXITY LEVELS (CONT)
GRID COMPLEXITY LEVELS (CONT)
MODEL DISPLAY NOW SUPPORTS COLOR-BASED REAL CONSTANTS
A perimeter around pad can be reinforced or just mesh refined. The core structure can be stiffened as well as any back facesheet isogrid pattern in region of bond pads.
LASTEST GUI WITH MORE EFFICIENT MESH ALGORITHM
ONLY APPROPRIATE ENTREES ACTIVE FOR INPUT
STATUS

• Currently undergoing ITAR review to determine any distribution restrictions.
• NASA is working on licensing, revision control and error reporting mechanisms.
• User Manual and tutorials under development.
• Short course or seminar under discussion.
• List of possible enhancements and requested features growing daily.

• Time permitting are there any questions?