Astronaut Scheduling Assistant: A Biomathematical Model of the Neurobehavioral Performance Capability of Shuttle Crews

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My background…

- Mech. & Aero. Engineering from UC Davis.
- Masters in Human Factors Engineering & Masters in Systems Engineering (emphasis on mathematical modeling).
- Worked as a Space Systems Engineer, designed interfaces for Satellite Operators and Shuttle Crew.
- Followed the Sleep Research from a distance.

My tasks…

- Analyze various models, develop most appropriate model for our needs, & help build interface and algorithms for the Astronaut Scheduling Assistant.

Fatigue & Performance Modeling Workshop (June 13-14th Seattle)

- Sponsored by NASA, US Dept. of Defense, US Army Medical Research and Materiel Command, Office of Naval Research, Air Force Office of Scientific Research, US Dept. of Transportation.

- Assess the biomathematical models of fatigue and performance.
  - Compare, contrast and evaluate
  - Identify critical gaps
  - Publicize and refine federal agency requirements

Modelers will receive…

- Description of a Univ. Penn sleep/performance “laboratory” study.
- Description of VOLPE generated “real world” sleep/performance study (train engineers and US Coast Guard)
- Description of a NASA generated ultra long range piloting schedule.

Modelers will not receive…

- The results of the studies.

Survey (portion) sent to modelers

8. List current users for your model :
1. Scientific Researchers 2. NASA/DOD Scientists 3. Boeing/Air Bus Ultra-Long Range plane developers

9. What agency(ies), if any, supported the development of your model?
NASA NSBRI AFOSR DARPA NIH ARO

10. Broadly categorize what your model currently seeks to predict.

- _X_ Prediction of key aspects of **subjective state** (e.g., fatigue, sleepiness).
- _X_ Prediction of key aspects of **performance** (e.g., cognitive, physical).
- _X_ Prediction of key aspects of **physiology** (e.g., physiological alertness, sleep structure).
- ____ Prediction of key aspects of **accident risk**.
- ____ Prediction of key aspects of **optimal work-rest schedules**
- _X_ Prediction of **impact of specific countermeasures** (e.g., nap, caffeine).
- _X_ Prediction of **other** : circadian phase

Additional comments/details :

11. Describe the current focus or goals of your model.

Predict results from laboratory experiments.

- _X_ simulated shift work
- _X_ simulated sustained or continuous operations
- _X_ chronic partial sleep deprivation
- _X_ simulated jet lag
- _X_ effects of countermeasures (behavioral, pharmacological, technological)
- _X_ other : circadian effects of exposure to light

Predict results from field operations.

- _X_ length of work shift
- _X_ shift work / night work operations
- _X_ sustained or continuous operations
- _X_ jet lag
- _X_ other : non-24-h schedules

Additional comments/details :

The Models

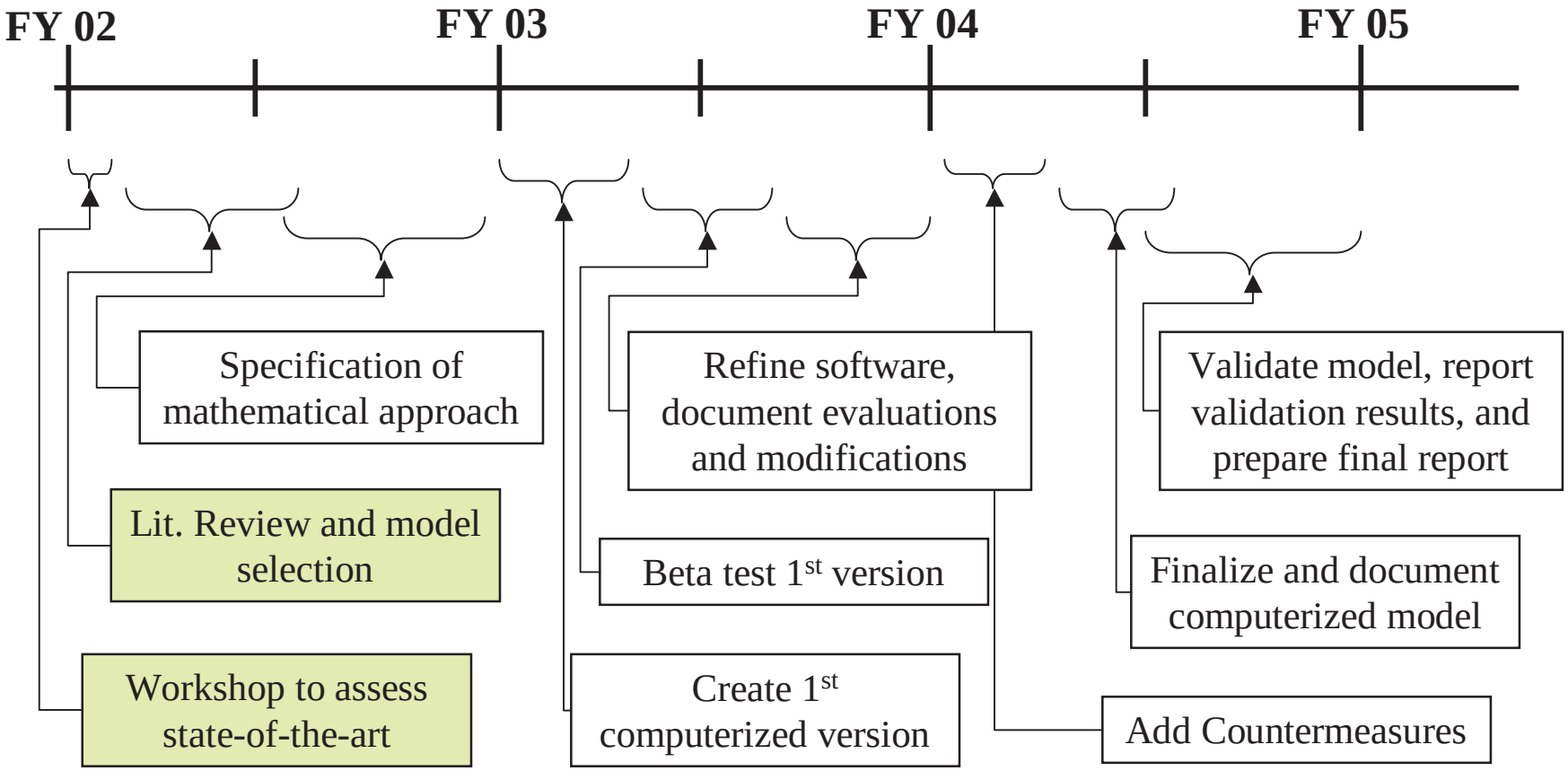
Model authors	survey	input / output	Refer.	Competent (me)
Peter Achermann	✓			
Drew Dawson & Adam Fletcher	✓	✓	✓	✓
Torborn Akerstedt, Simon Folkard & Christian Portin	✓	✓	✓	✓
Steven Hursh, Col. Redmond & Col. Belenky	✓			
Megan Jewett & Richard Kronauer	✓	✓		
Jon French	✓	✓	✓	
Martin Moore-Ede, Anneke Heitman, Udo Trutschel & Rainer Guttkuhn	✓	✓		
Mick Spencer				

Performance measures…

- Working with Dr. Van Dongen (UPENN)
- Scaling & converting the various model outputs (alertness, fatigue levels, sleep propensity, etc. into performance).
- Converting the laboratory and VOLPE data into the same performance scale.

Scheduling Tool Project Milestones

We're on schedule…



also…

- Examining the likely work schedule of the space station astronauts.
- Collecting previous sleep performance data to compare/validate with our various model outputs.
- Summarizing the surveys returned by the modelers.

next quarter…

- Continue to learn the “ins-and-outs” of each model.
- Start to compare the models with performance data.

issues…

- None, we are on track.