SAND2018-8553C

Strategic facilities space management modeling for better decision support

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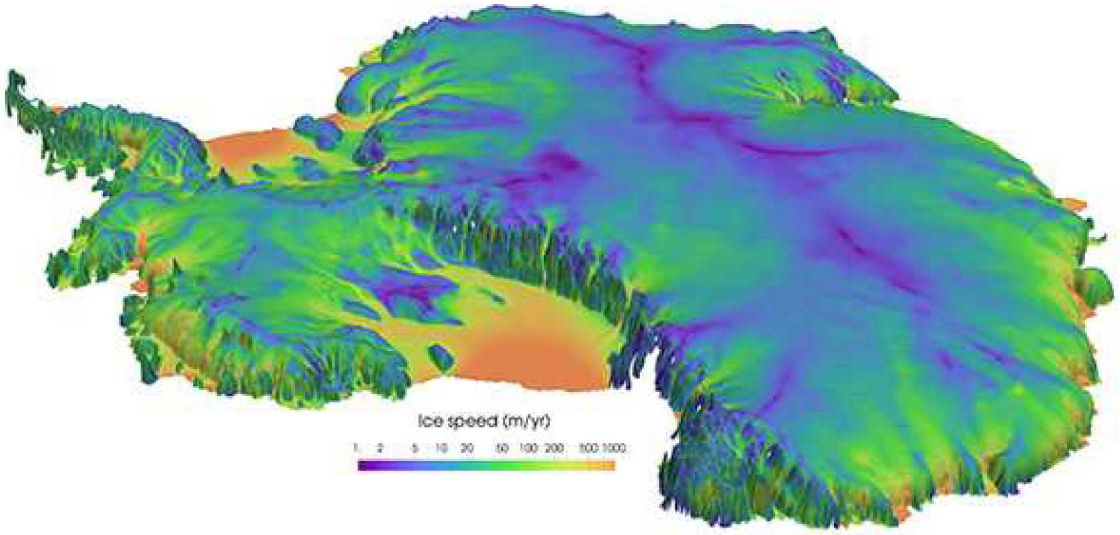
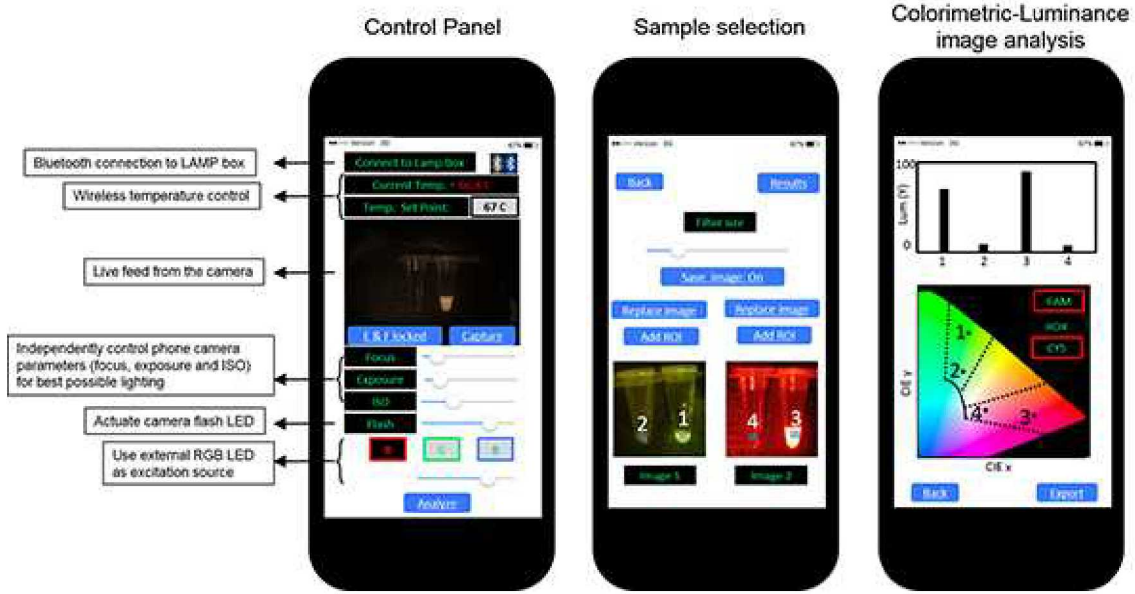
Introduction: Sandia National Laboratories

- Sandia National Laboratories (Sandia) is a Department of Energy Federally Funded Research and Development Center which provides critical engineering and scientific support to a variety of US Government (USG) agencies.





Problem Statement

- A broad range of facilities that support Sandia efforts.
- Managing, preparing, and predicting future needs at spread out sites is complex. Further adding to complications are:
  - Rules governing USG acquisition of space—sometimes requiring a multi-year effort;
  - USG efforts to "freeze" and reduce the federal government footprint[1];
  - The nature of the work makes wide adoption of telecommuting unfeasible; and
  - The dynamic processes that govern hiring, clearing individuals, and funding.

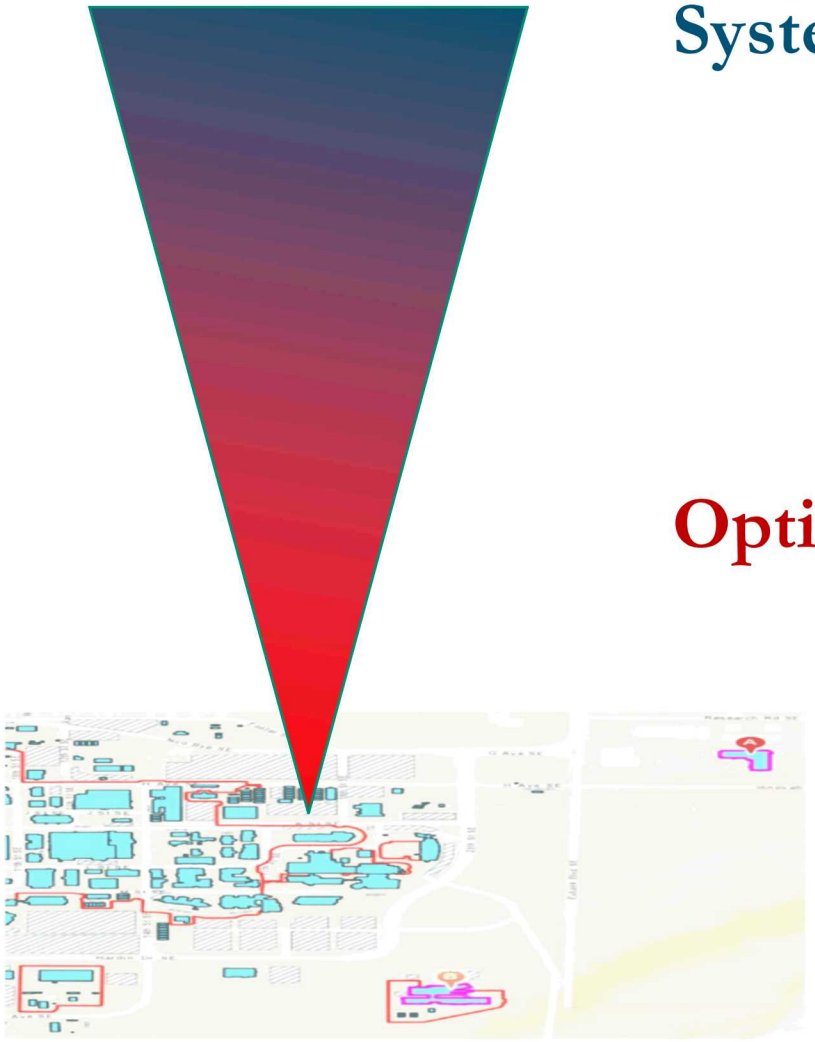
Lack of readymade tools that can simulate future space needs and help manage and optimize facilities.

Value to Solving Problem

Solving the problem will:

- Enable considered decision-making
- Enables for robustness/resilience analyses to understand potential issues
- Help anticipate challenges
- Allow exploration of policy effects on mission performance.

The right tools for the job



System Dynamics Model (Saw)

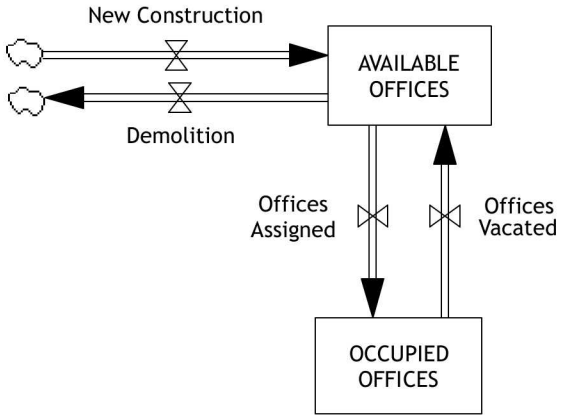
- Outputs are at a lab- to building-level
- Explore general large solution space for a large range
- Inputs can be high-level (non-specific)

Optimization Model (Scalpel)

- Output can recommend specific solutions at building to office levels
- Explore specific solution parameters
- Inputs must be defined at a micro-level

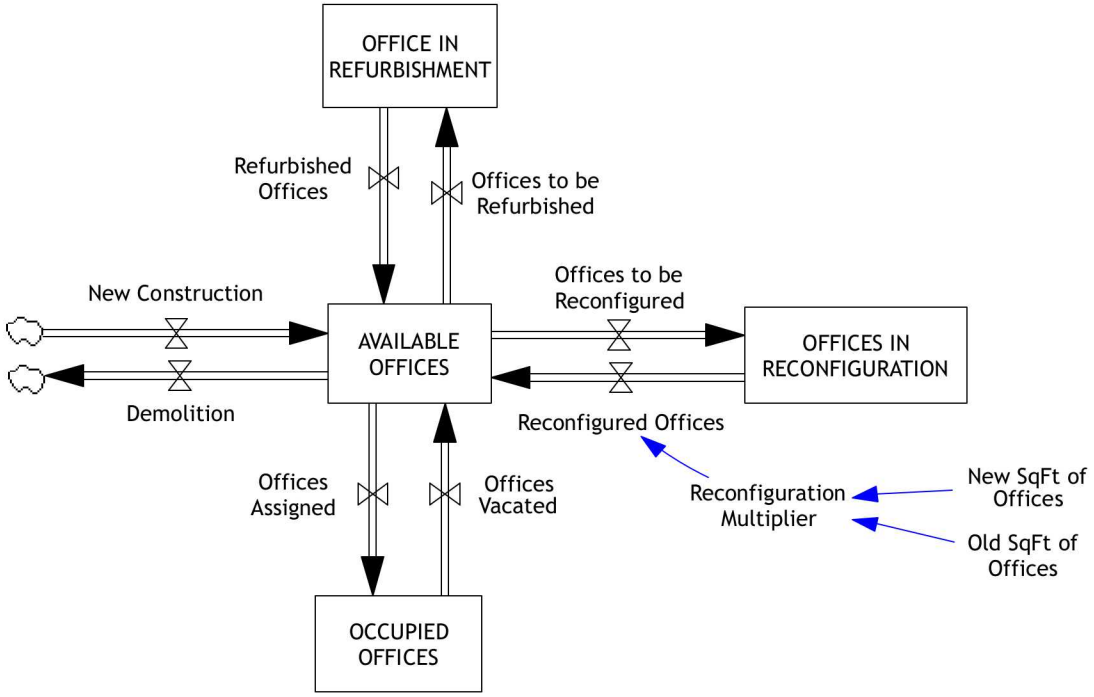
Core Model Logic

Office Space Logic: Availability and Occupancy



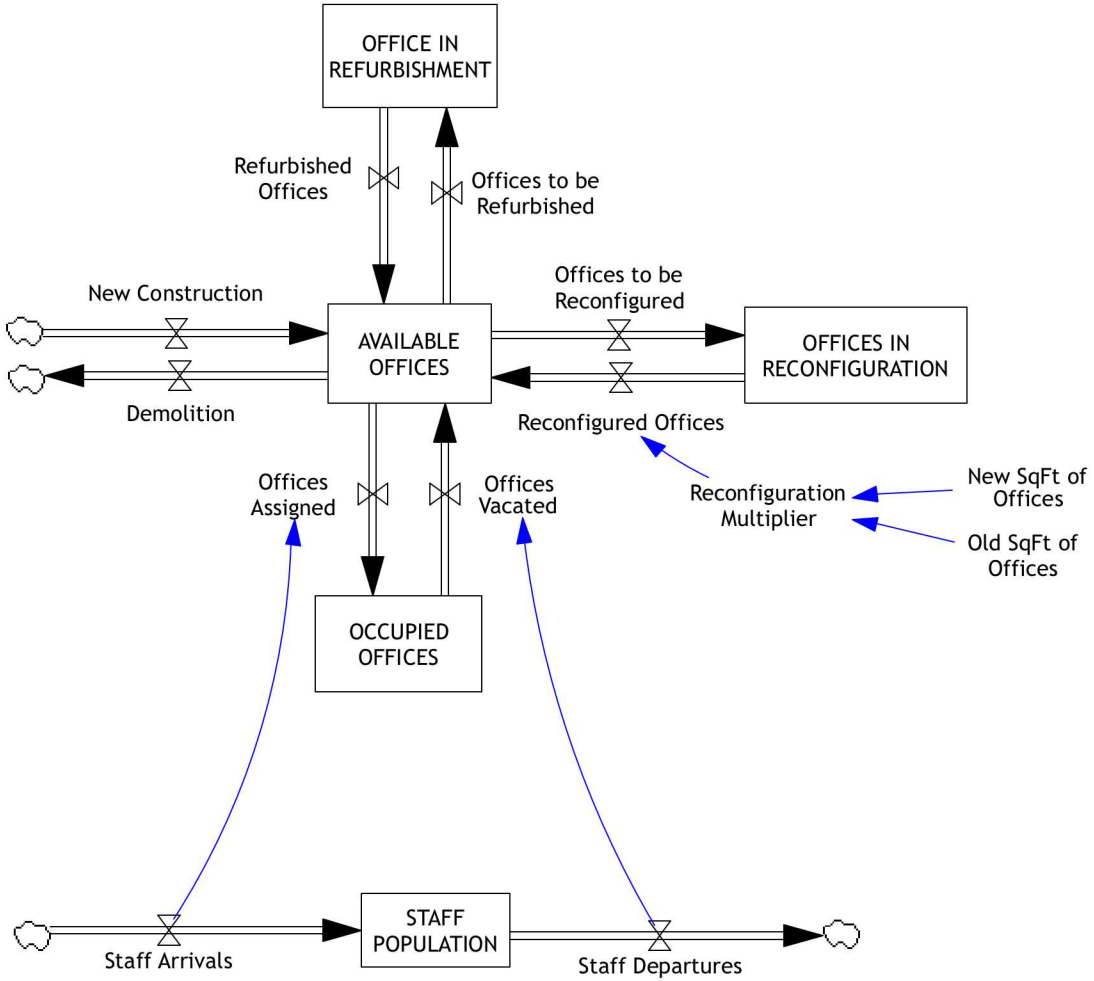
- Offices are either occupied or available.
- Office availability can change states based on office assignments and vacating.
- Offices can be added to the system through construction or removed via demolition.
- Generally speaking office buildings are vacated before being demolished, and people are not born in offices.

Office Space Logic: Refurbishment and Reconfiguration



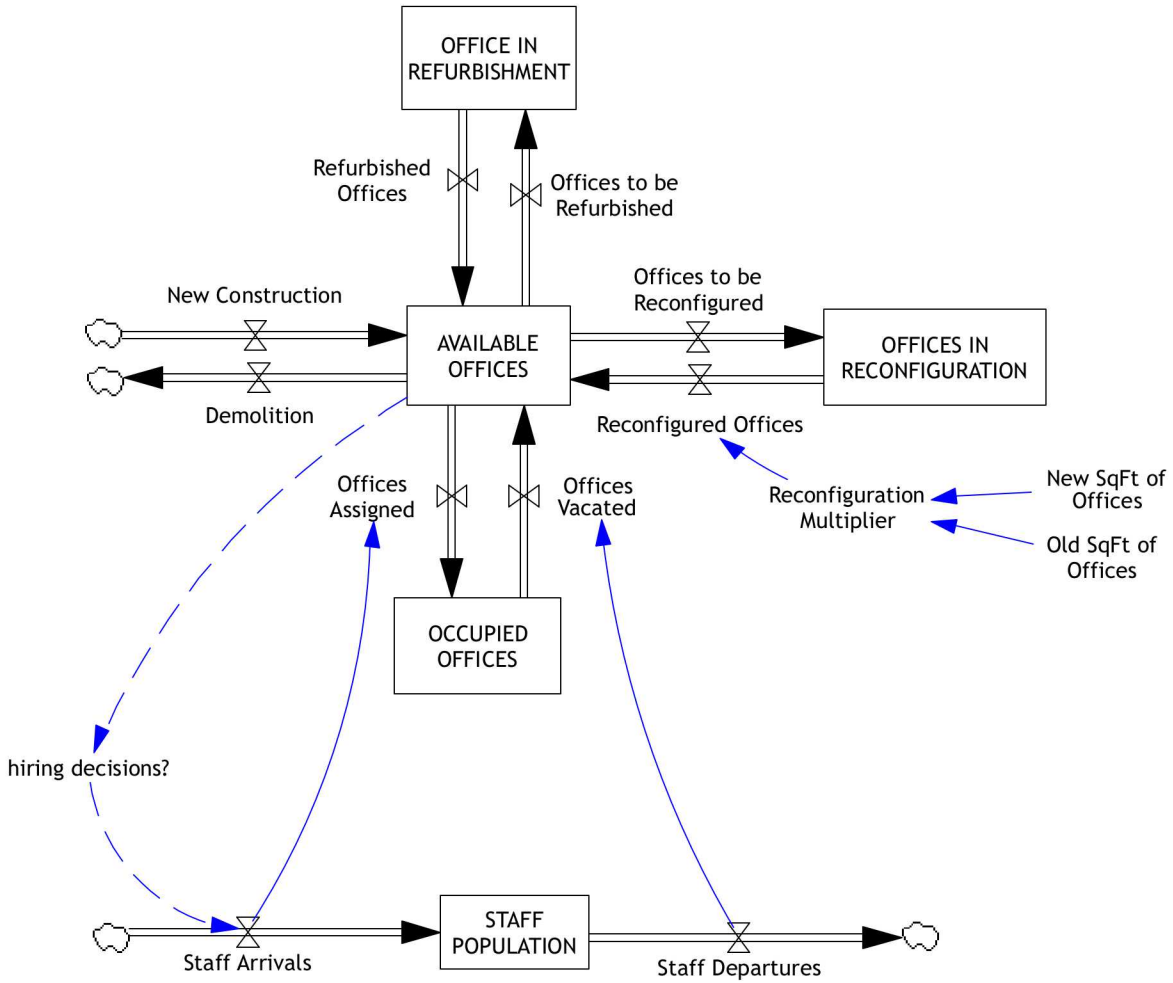
- Offices can also be reconfigured or refurbished.
- Reconfiguration changes the number of office seats available whereas refurbishment changes the quality of the space.
- While spaces are in these states, they are not able to be occupied.
- There is a time delay for each of these processes.

Staff Effects



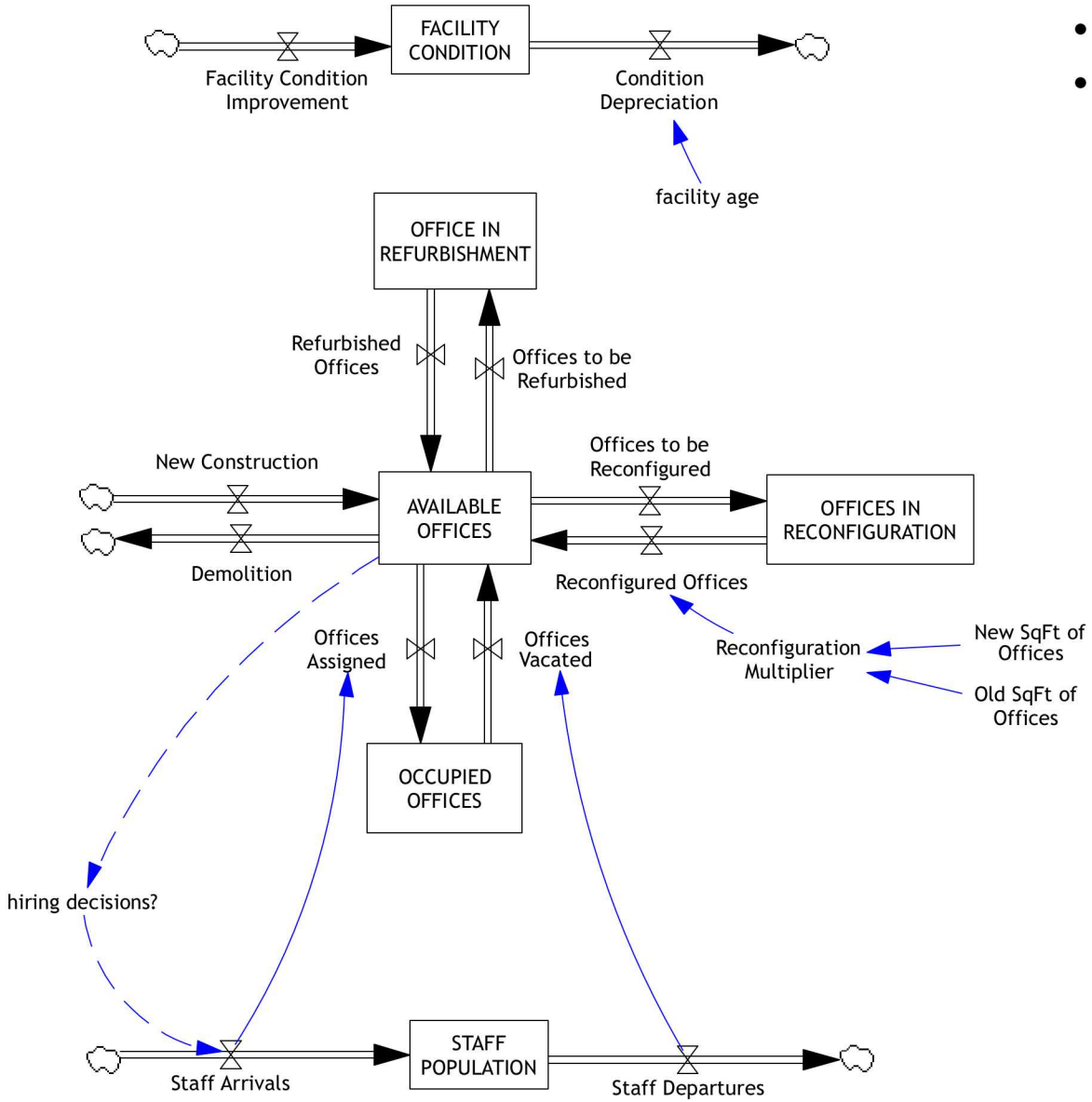
- Staffing affects the use of the office space.
- When new staff arrives they are assigned offices.
- As staff departs they vacate offices.

Does space availability affect hiring? (should it?)



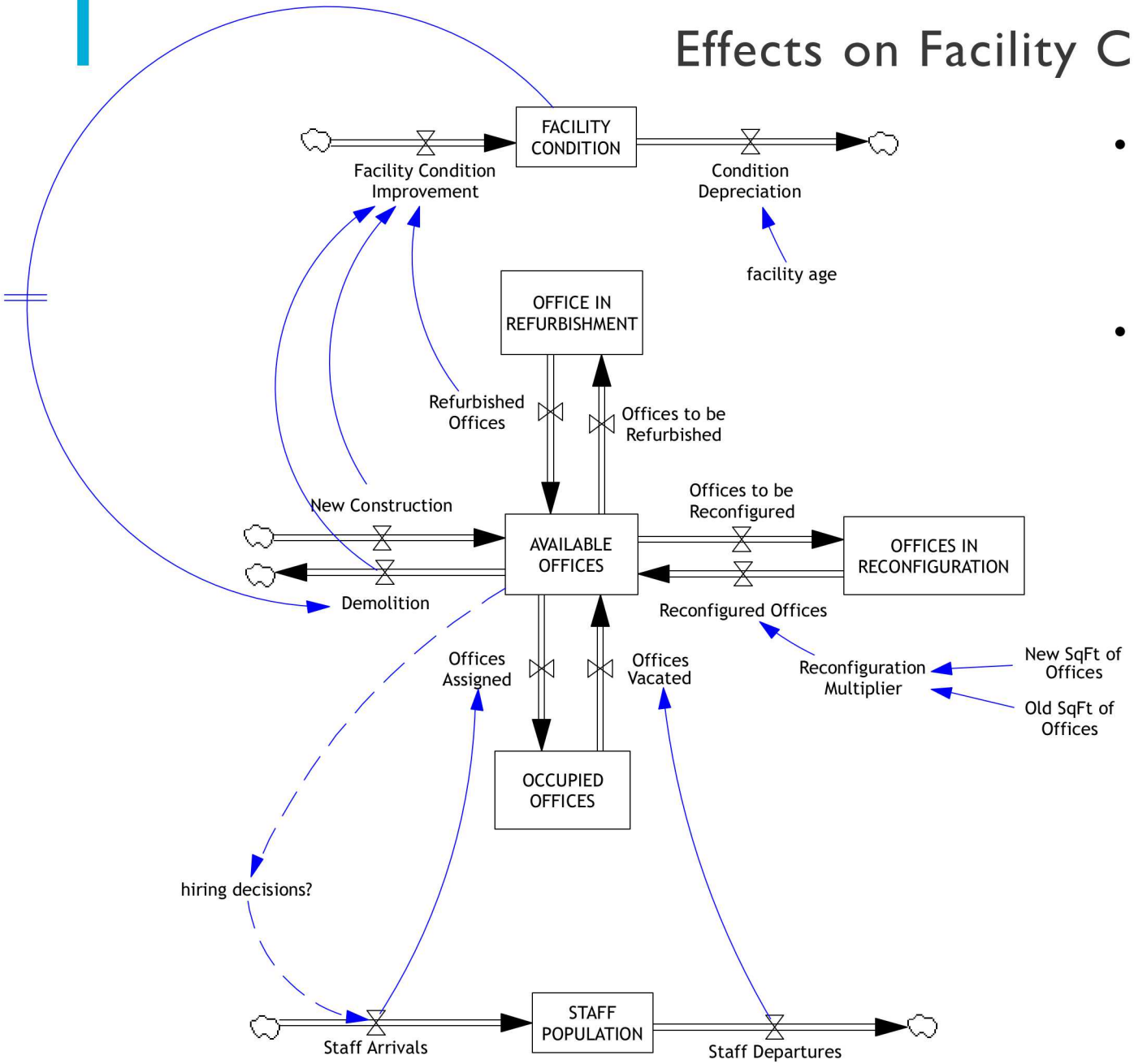
- We can theorize that the availability of offices can drive hiring decisions.
- However, hiring is controlled by a general lab-wide decisions to change the lab population.
- Decisions to hire staff are based on programmatic needs and financial capacity.
- While on a broad basis, there is a maximum capacity that the lab can house, there is no policy in place that would limit hiring due to space constraints
  - There are times when one may have no choice but to hire (times of exigent national need etc.).
- Does space availability affect hiring? No!
- Should it? Under normal circumstances, yes.
- Also: While not represented there are signals between space availability and space reconfiguration

Facility condition



- Another aspect to consider is facility condition.
- Facility condition degrades with time but can be renewed with improvements.

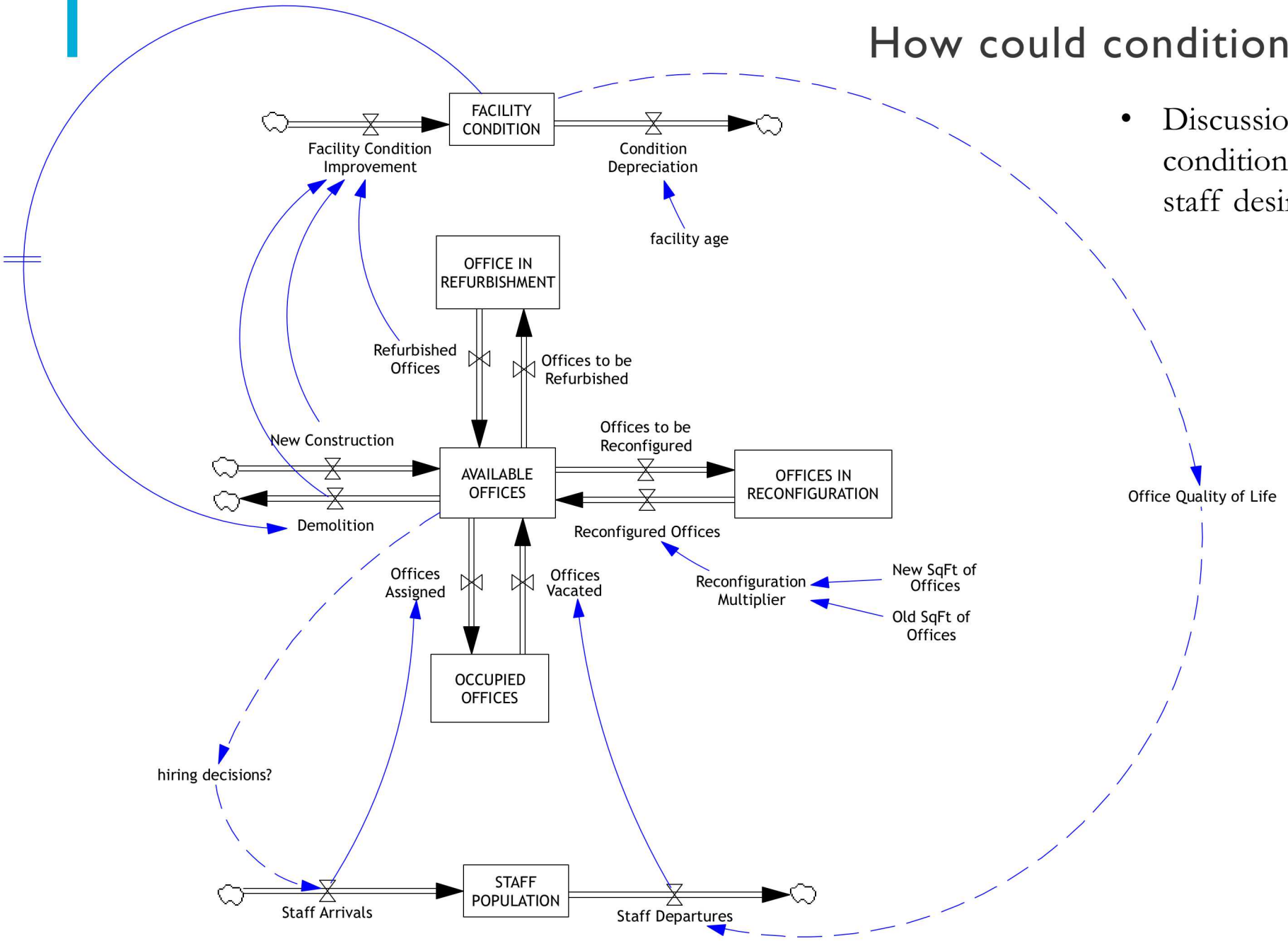
Effects on Facility Condition



- Office Refurbishment, New Construction, and Demolition of old facilities will improve the aggregate facility conditions.
- Demolition of facilities can be driven by the overall condition of the facilities.

How could conditions affect staff?

- Discussion Question: Could the condition of facilities can also impact staff desire to stay at Sandia?

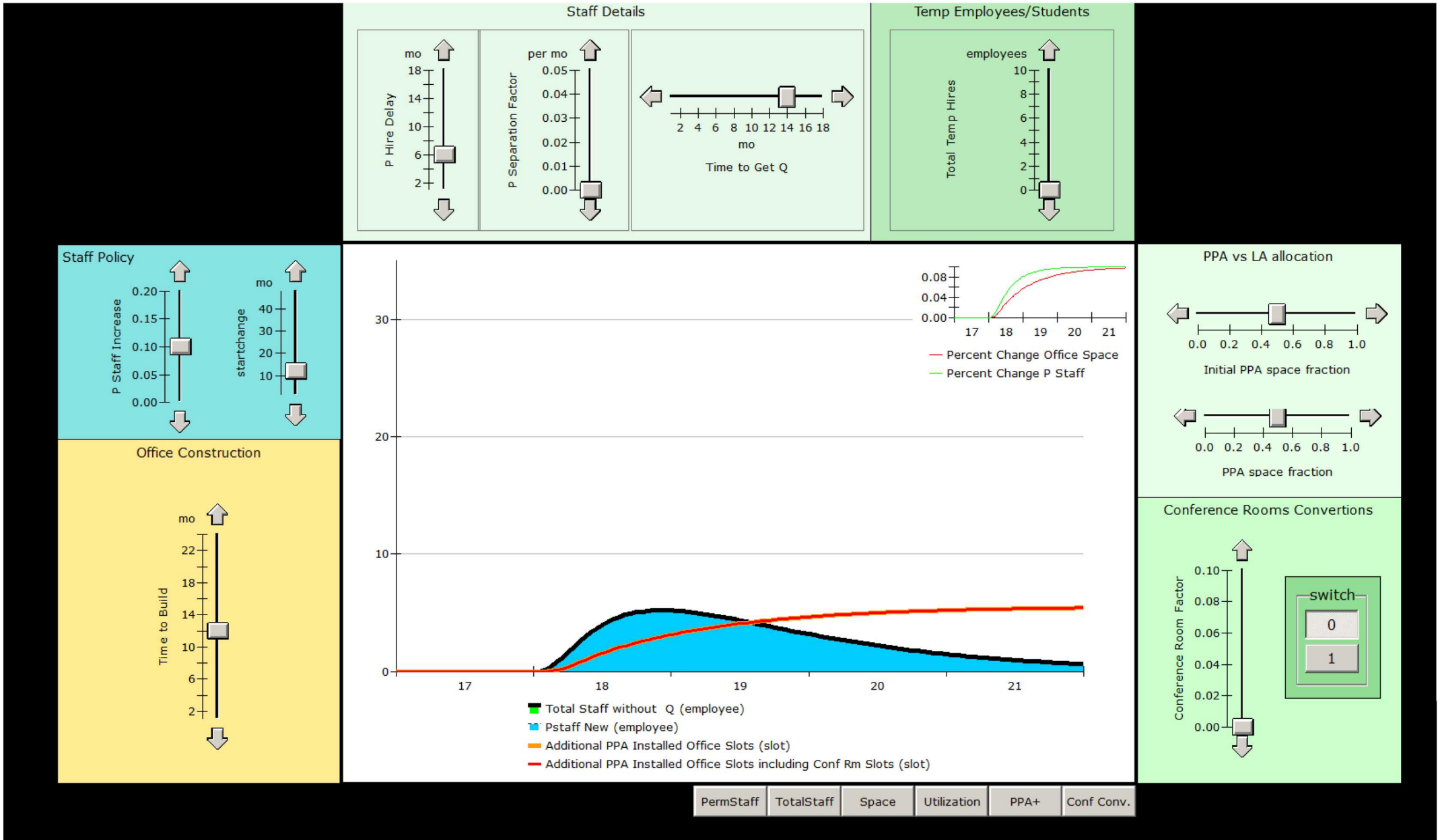


Models

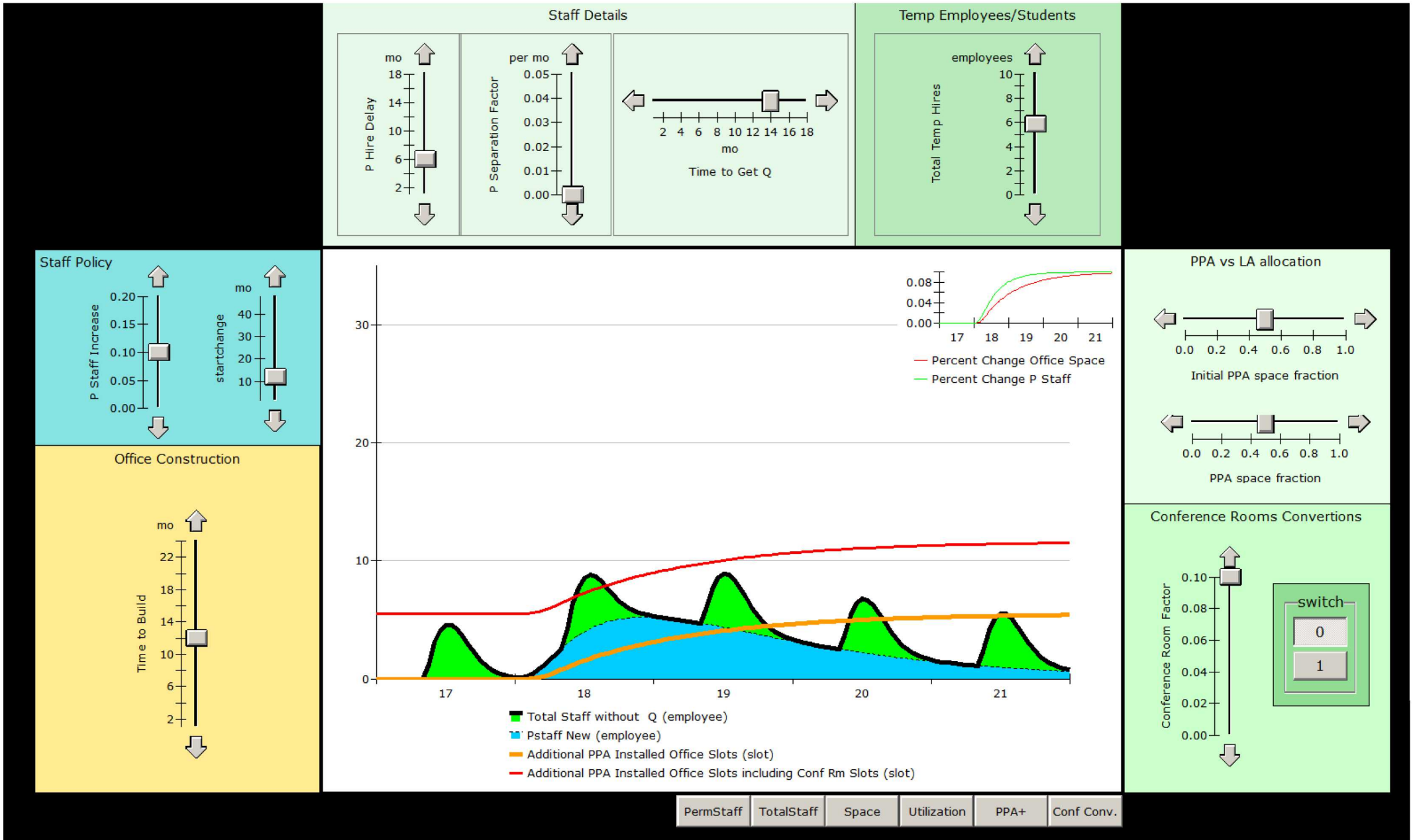
- We developed two models using this logic
  - A Thumbnail model to experiment with strategies
    - Thumbnail model has NO REAL DATA
    - Used for exploring dynamics and prototyping functionality on the larger model
  - A Full model with details to help with on the ground decision-making
    - Full model has REAL SYSTEM DATA
    - Can be used for trade off decisions
    - Outputs can be exported an used to make real operational decisions!

Thumbnail Model

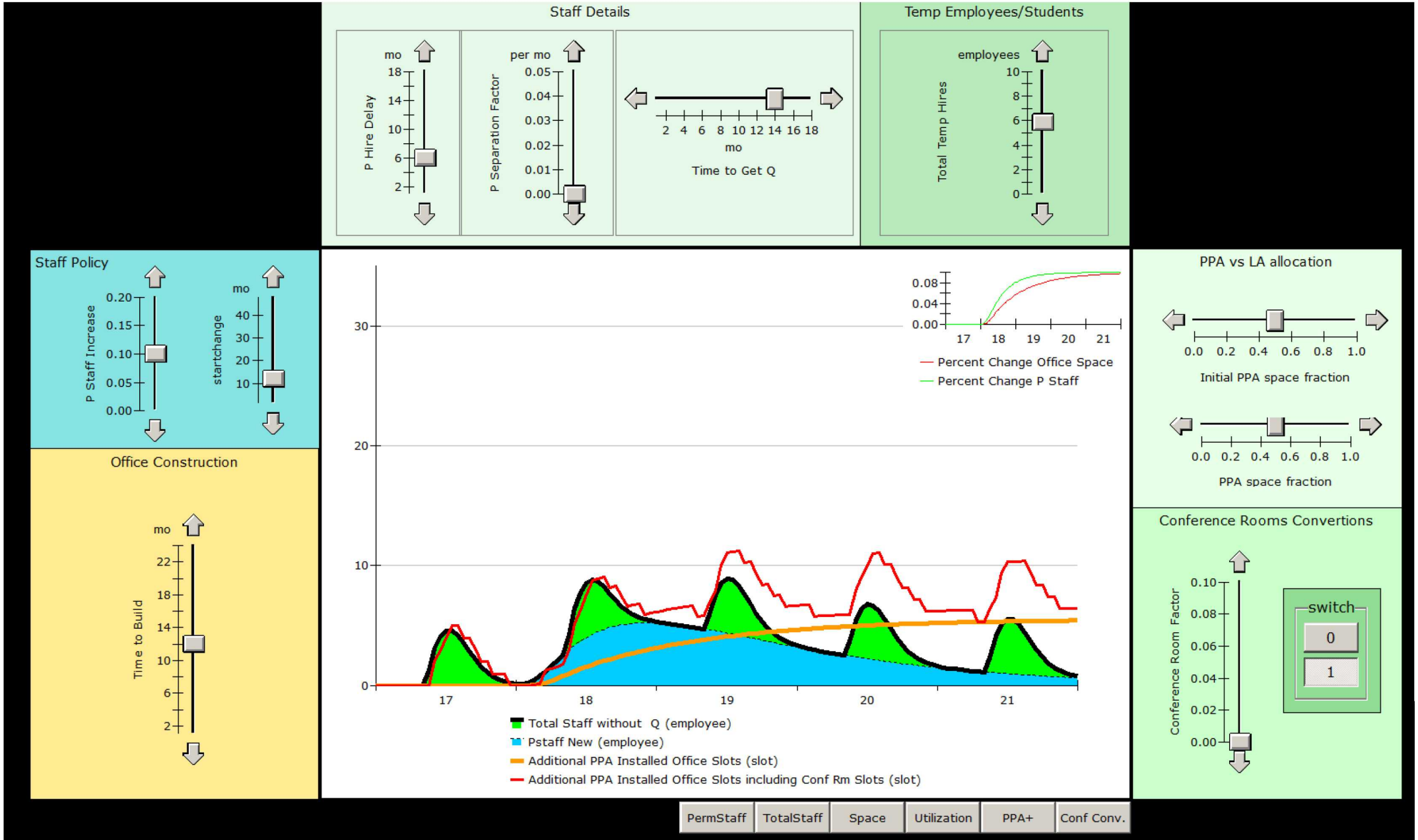
Baseline Run (Thumbnail model: Total Uncleared Staff View)



Converting Conf Rooms (Thumbnail model: Total Uncleared Staff View)



Active Rooms Conversion (Thumbnail model: Total Uncleared Staff View)



Full Model

Intent of the Full Model

The full model is intended to help Sandia Facilities make decisions regarding to ensure that future growth at the labs can be accommodated.

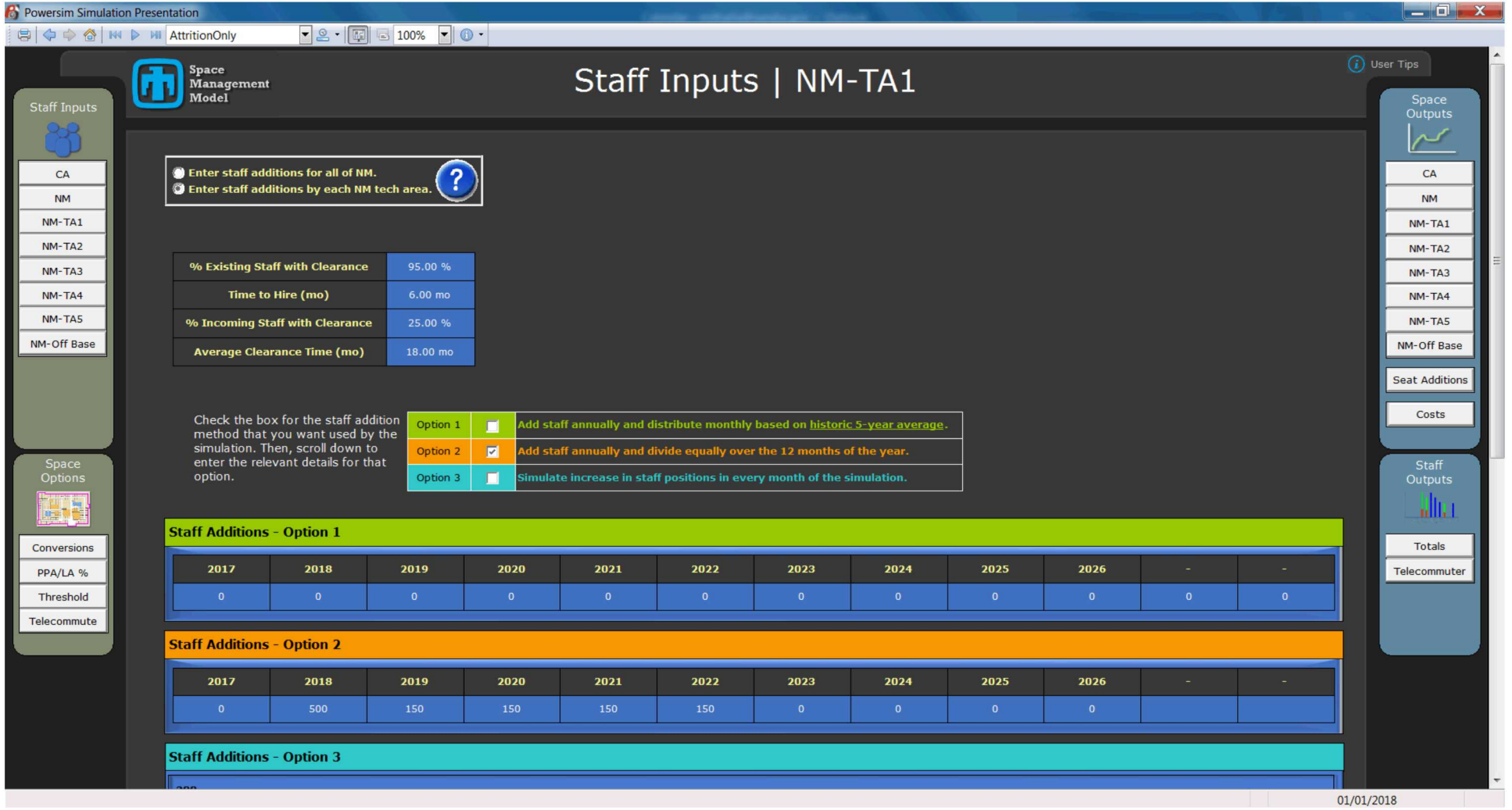
There are several investment options to increase office capacity at the laboratories:

1. Construction of buildings (most expensive)
2. Leasing space
3. Converting spaces into offices
4. Resizing office spaces
5. Telecommuting (least expensive)

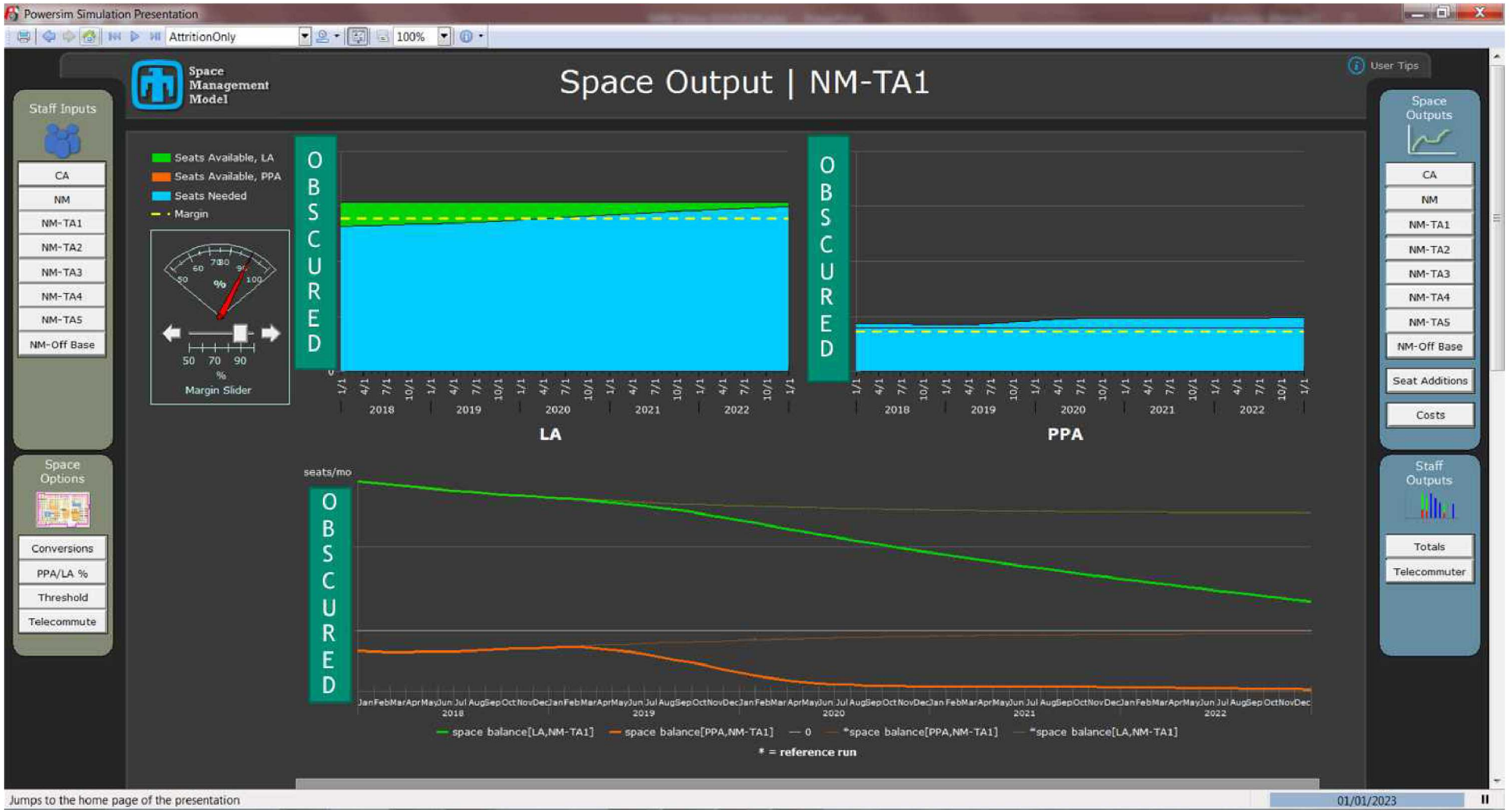
In the model we refer to two security areas:

- The Limited Area (LA) this is an area that is only accessible to certain personnel.
- The Property Protected Area (PPA) this is an area that is accessible to all personnel.

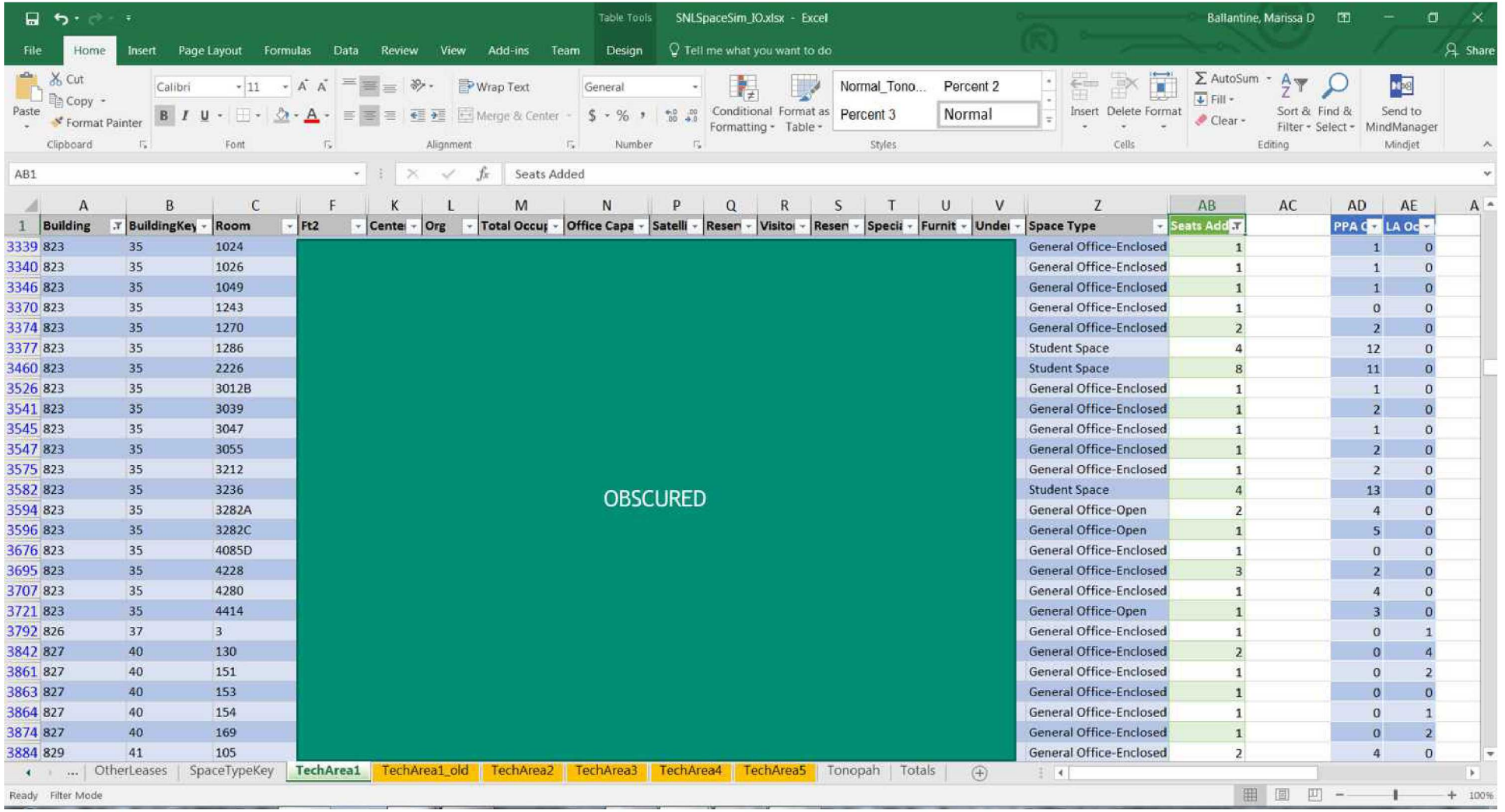
All potentially proprietary numerical values are obscured to prevent release of data.



- What would happen if additional office seats were needed in TA1?
  - 500 in 2018, added evenly over the 12 months of the year
  - 150 in 2019 through 2022, added evenly over the 12 months of the year



- Faint, dashed lines on the bottom plot represent the model run with attrition only
- Staff additions tax the LA, but do not cause a shortage
- The shortage in the PPA becomes much greater, as the new staff await clearances



	Building	BuildingKey	Room	Space Type	Seats Add	PPA	LA Oc
3339	823	35	1024	General Office-Enclosed	1	1	0
3340	823	35	1026	General Office-Enclosed	1	1	0
3346	823	35	1049	General Office-Enclosed	1	1	0
3370	823	35	1243	General Office-Enclosed	1	0	0
3374	823	35	1270	General Office-Enclosed	2	2	0
3377	823	35	1286	Student Space	4	12	0
3460	823	35	2226	Student Space	8	11	0
3526	823	35	3012B	General Office-Enclosed	1	1	0
3541	823	35	3039	General Office-Enclosed	1	2	0
3545	823	35	3047	General Office-Enclosed	1	1	0
3547	823	35	3055	General Office-Enclosed	1	2	0
3575	823	35	3212	General Office-Enclosed	1	2	0
3582	823	35	3236	Student Space	4	13	0
3594	823	35	3282A	General Office-Open	2	4	0
3596	823	35	3282C	General Office-Open	1	5	0
3676	823	35	4085D	General Office-Enclosed	1	0	0
3695	823	35	4228	General Office-Enclosed	3	2	0
3707	823	35	4280	General Office-Enclosed	1	4	0
3721	823	35	4414	General Office-Open	1	3	0
3792	826	37	3	General Office-Enclosed	1	0	1
3842	827	40	130	General Office-Enclosed	2	0	4
3861	827	40	151	General Office-Enclosed	1	0	2
3863	827	40	153	General Office-Enclosed	1	0	0
3864	827	40	154	General Office-Enclosed	1	0	1
3874	827	40	169	General Office-Enclosed	1	0	2
3884	829	41	105	General Office-Enclosed	2	4	0

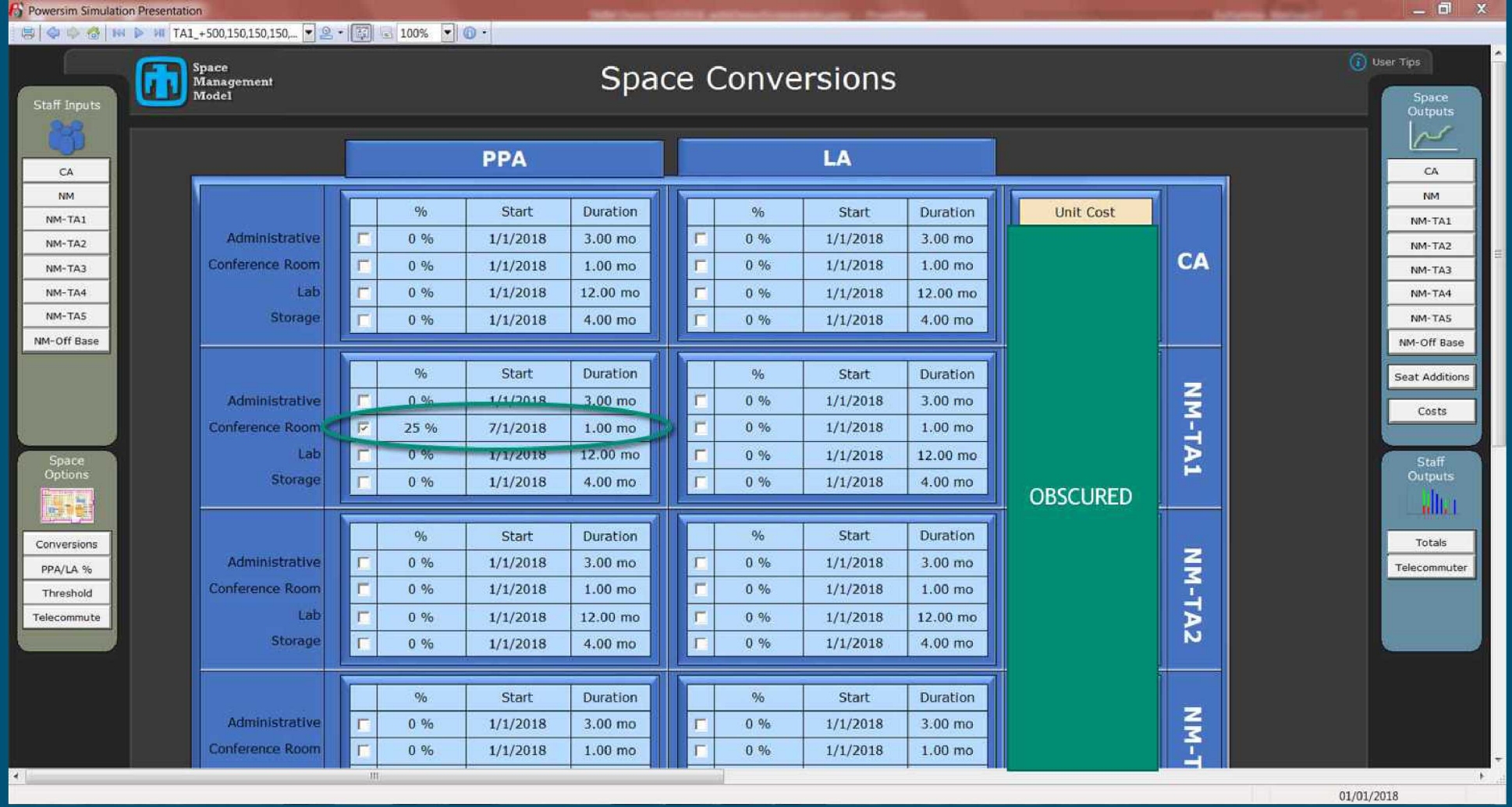
- The spreadsheet used the feed data to the model also is used to save and view seat additions by office
- The view shown here shows how many seats (green-filled column AB) were added by specific office in 823

Discussion and Questions

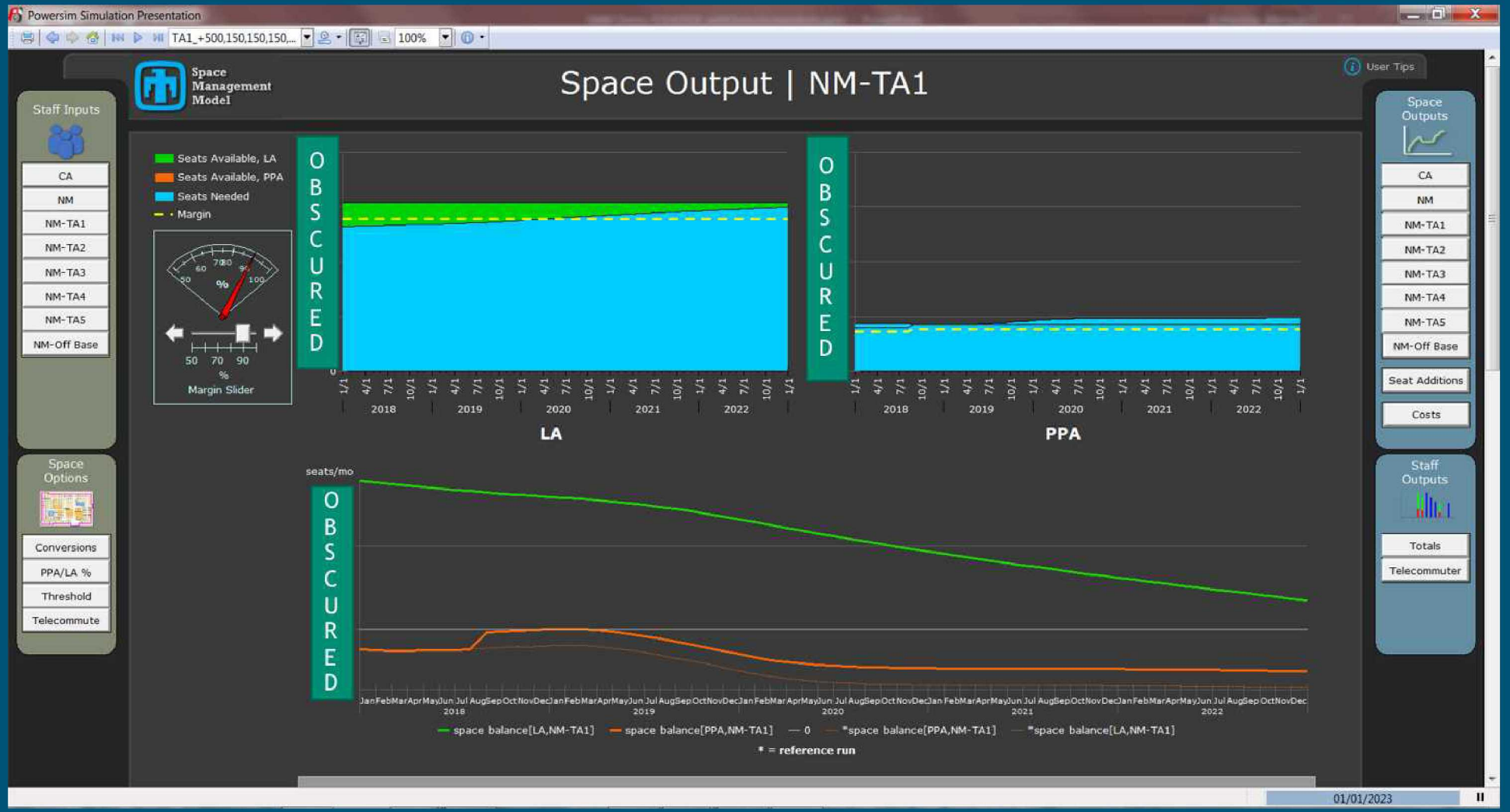
- We have developed a set of tools that is currently being refined for use in facilities strategic planning.
- Our System Dynamics model is helping Sandia Facilities understand aggregate vacancy and occupancy and is helping facilities balance between different security area spaces to ensure the labs.
- The ability to project forward enables facilities to find solutions to potential future occupancy problems before they occur. They also enable some robustness assessments (not shown).
- While detailed data complicates the model significantly, it enables reporting of specific solutions for Sandia facilities. Output in excel format allow facilities planners to utilize output directly as they search for space opportunities.
- Next Steps: We are now refining the operational model U/I and functionality.
- **Any questions or comments?**

Thank You!

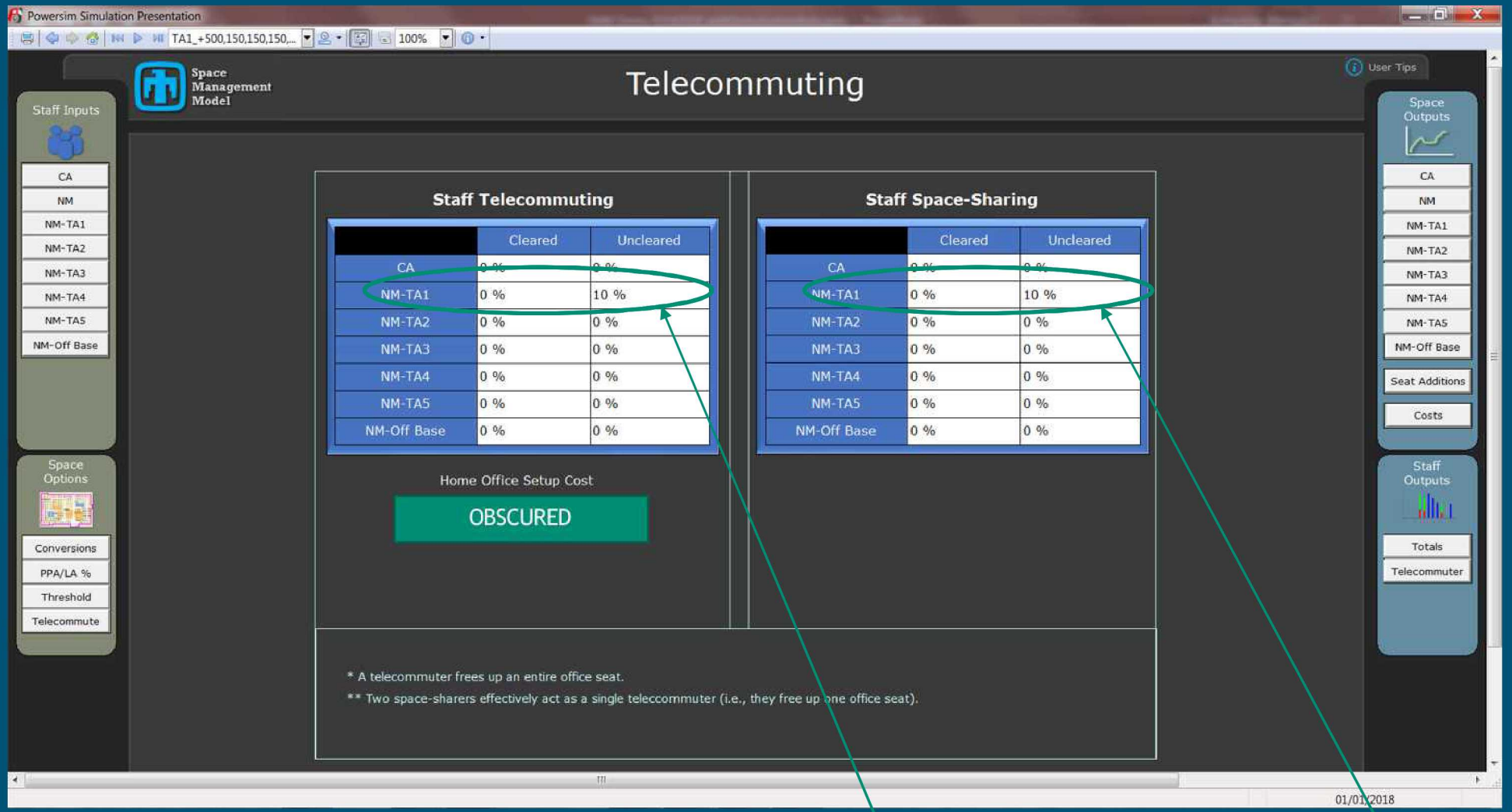
Back-up



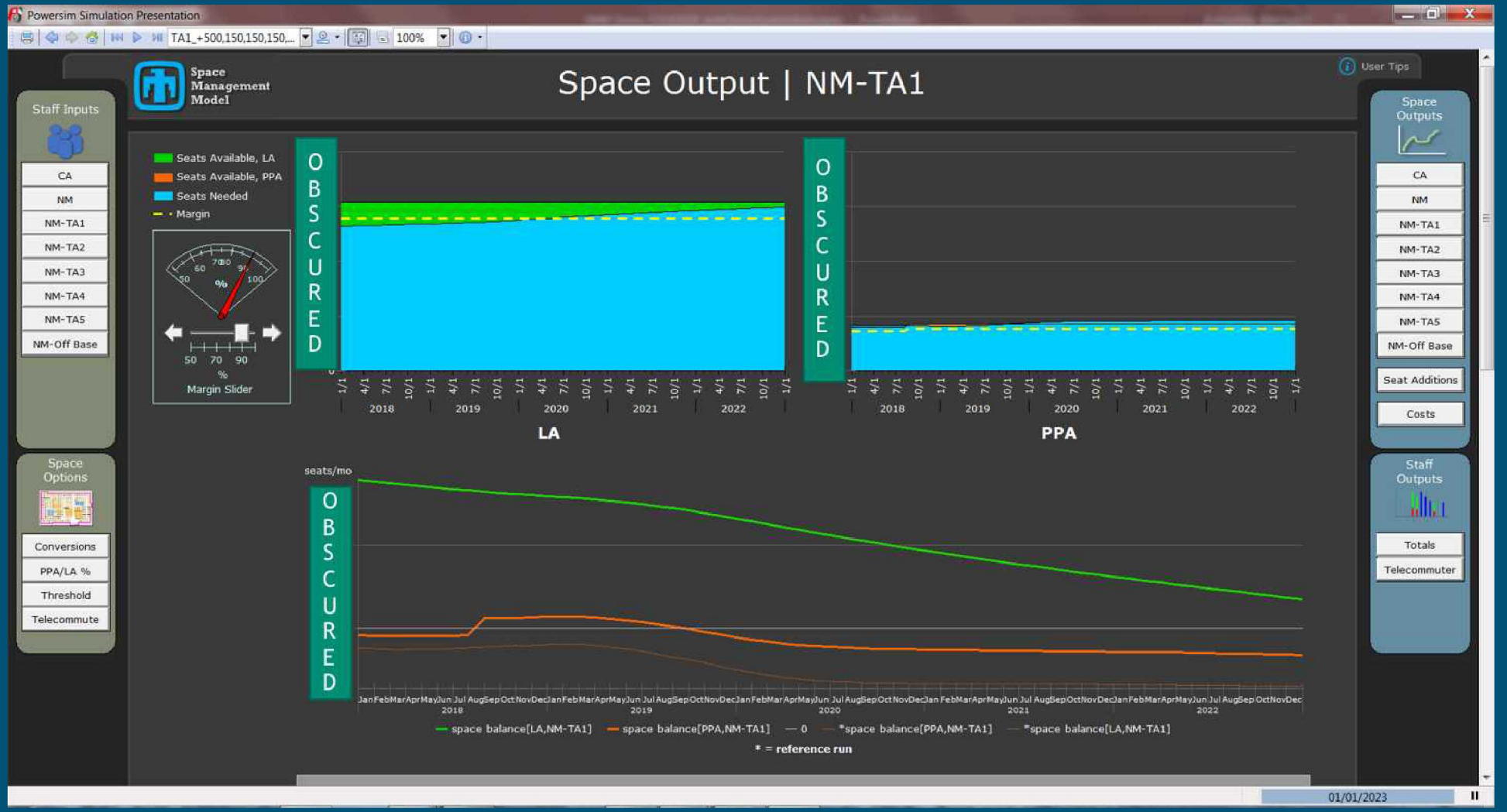
- Could the shortage of office seats in the PPA be abated by converting some Conference Room spaces in TA1 to offices?
  - 25% of all conference room space converted
  - Conversion starts 7/1/2018 and lasts 1 month
  - 70 square feet of conference room space = 1 office seat



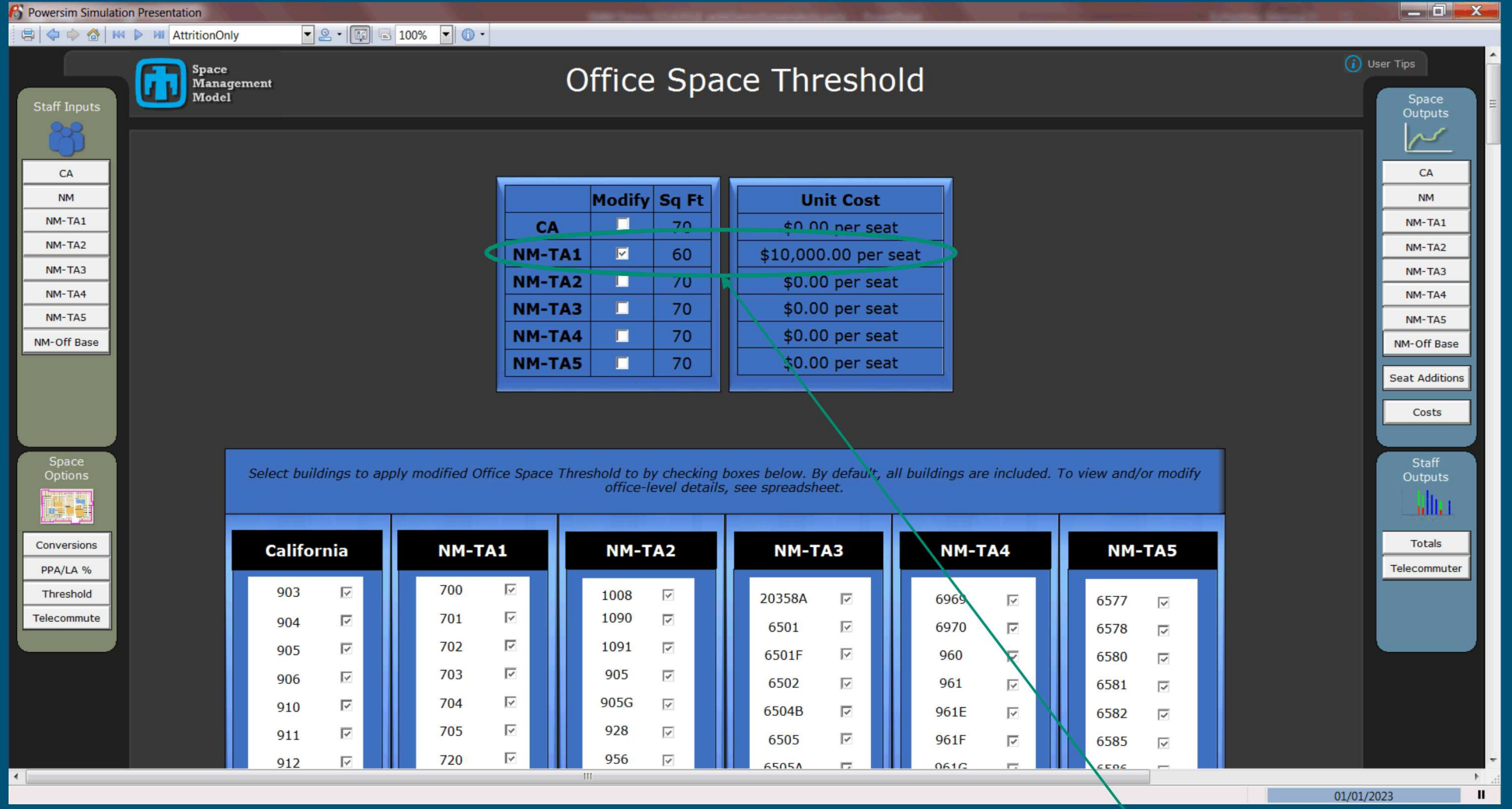
- Faint, dashed lines (bottom plot) are now from the model run with staff additions
- Conference Room conversions to office seats helps lessen but does not eliminate PPA office seat shortage



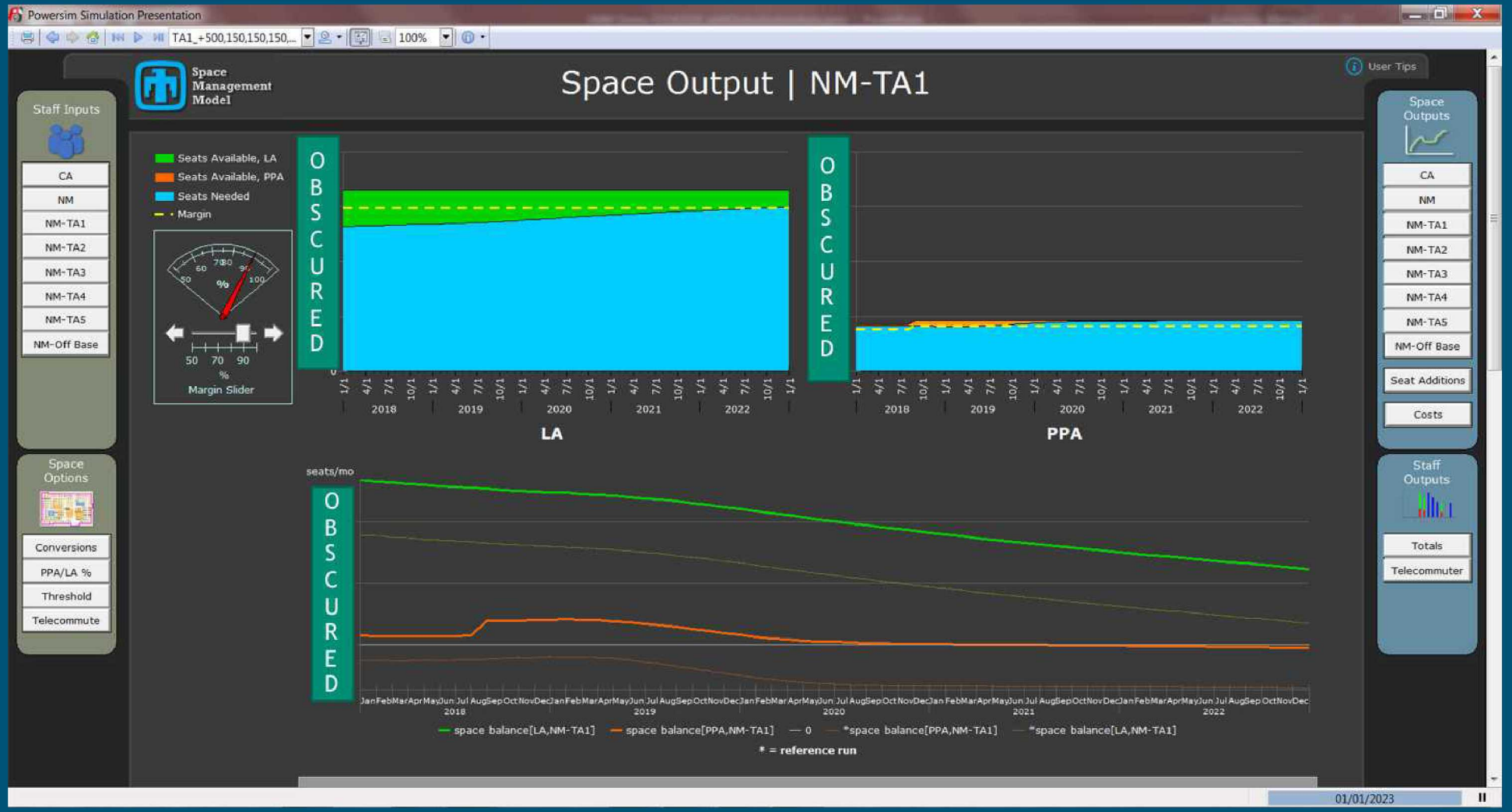
- If 10% of the uncleared staff in TA1 telecommuted and an additional 10% shared space, what would the space balance look like?
  - Since the seat shortage is in the PPA, only lessening the number of uncleared staff demanding space can help, hence this is the population that we assign to telecommute and share offices



- Telecommuting and space sharing, along with the Conference Room conversions to office seats eliminates the shortage in the PPA temporarily, but does not solve the problem entirely over the simulation period



- Could the shortage of office seats be eliminated entirely by reducing the space threshold from 70ft^2 to 60ft^2, at a cost of $10,000 per seat (notional cost)?
  - Walls are not torn down
  - If an office is 120ft^2 and currently has a capacity of 1, it would now have a capacity of two



- The shortage of office seats in the PPA is entirely eliminated by reducing the space threshold from 70ft^2 to 60ft^2, and the LA gains ~500 new seats
- The price tag on this scenario is $5.6M (notional cost)

Abstract (not for presentation)

Sandia National Laboratories (Sandia) is a Department of Energy Federally Funded Research and Development Center which provides critical engineering and scientific support to a variety of US Government (USG) agencies. A broad range of facilities spread across 2 main campuses and 6 ancillary locations support Sandia efforts.

Managing, preparing, and predicting future needs at spread out sites is complex. Further adding to complications are:

- Rules governing Sandia's acquisition of space—sometimes requiring a congressional line item;
- USG efforts to "freeze" and reduce the federal government footprint[1];
- The high-security nature of the work making telecommuting unfeasible at a large scale; and
- The many dynamic processes that govern hiring, clearing individuals, and securing funding.

There is a lack of readymade tools that can simulate USG specific future space needs and help organizations manage and optimize their facilities. Therefore, Sandia is developing system dynamics and optimization-based tools to aid decision-making in its centralized facilities policy.

This presentation describes the central logic underlying the system dynamics tool, explains the dimensional complexity involved with developing an operations model, demonstrate the current state of these tools, describes insights, and describes future developments for this project.

Note to Reviewers (not for presentation)

- This presentation represents our progress on this modeling project to date. If selected we will update our slides to represent our project/improvements made to our project.
- There are some details obscured due to customer sensitivities we will work with customers to make as much as possible viewable for presentation if we are selected.
- We currently have too many slides; however, we wanted to show the complexity of our project. We will pair down our slides if we are selected for presentation. We appreciate any suggestions on what we should focus.
- Irrespective of if this project is selected for presentation or not we appreciate any comments or questions.