

Strategic facilities space management modeling for better decision support



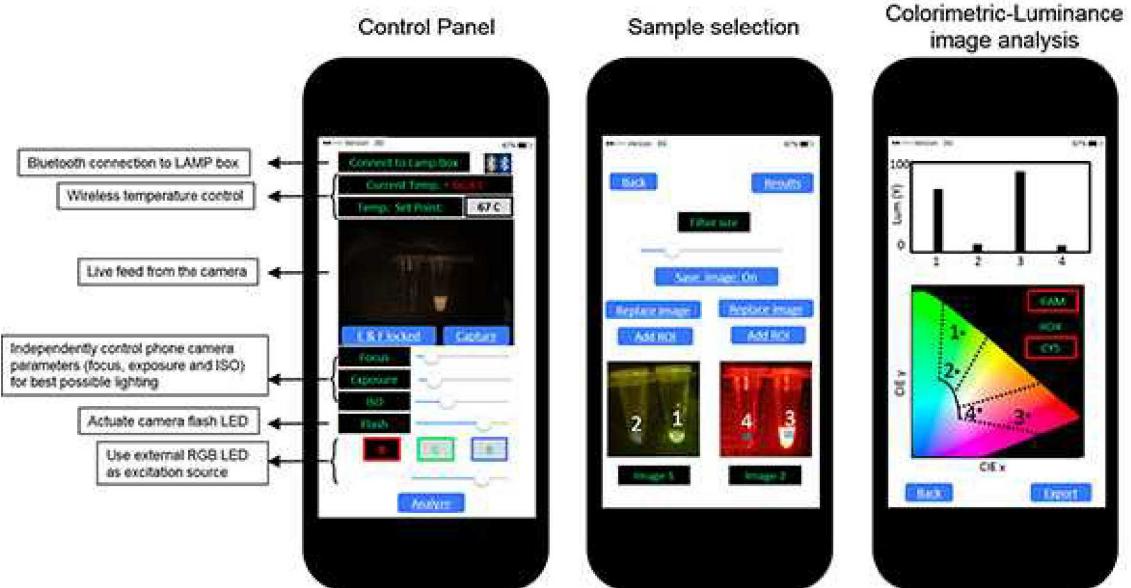
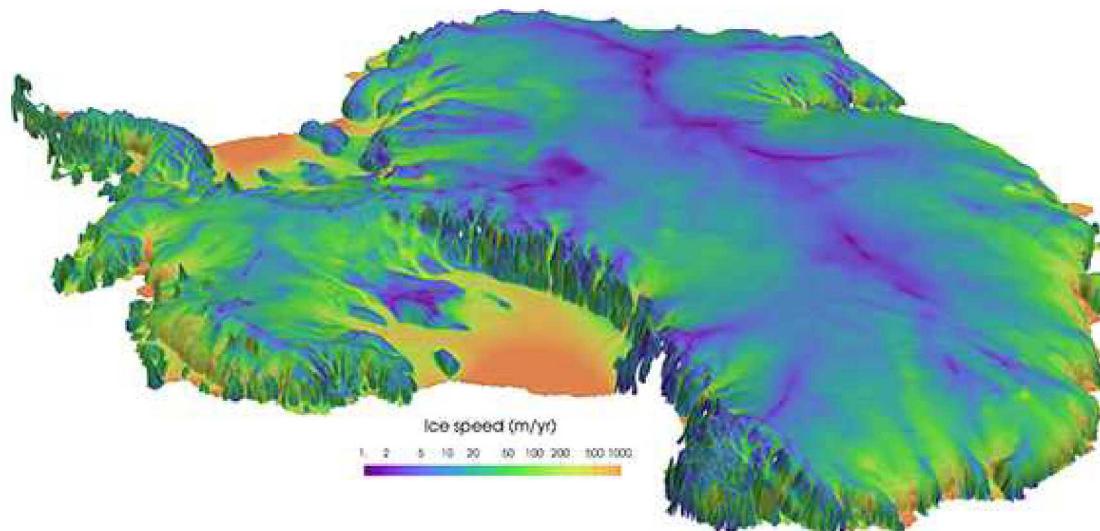
Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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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

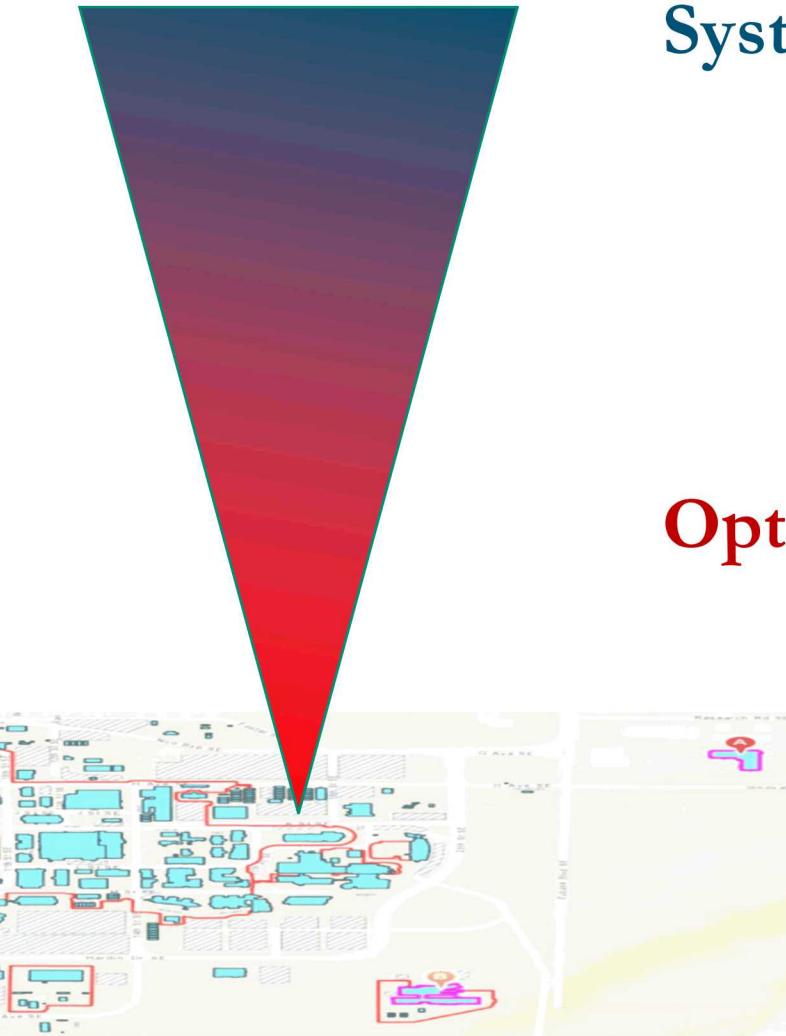
- A broad range of facilities that support Sandia efforts.
- Managing, preparing, and predicting future needs at spread out sites is complex. Further adding to complications are:
 - Rules governing USG acquisition of space—sometimes requiring a multi-year effort;
 - USG efforts to “freeze” and reduce 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.



System Dynamics Model (Saw)

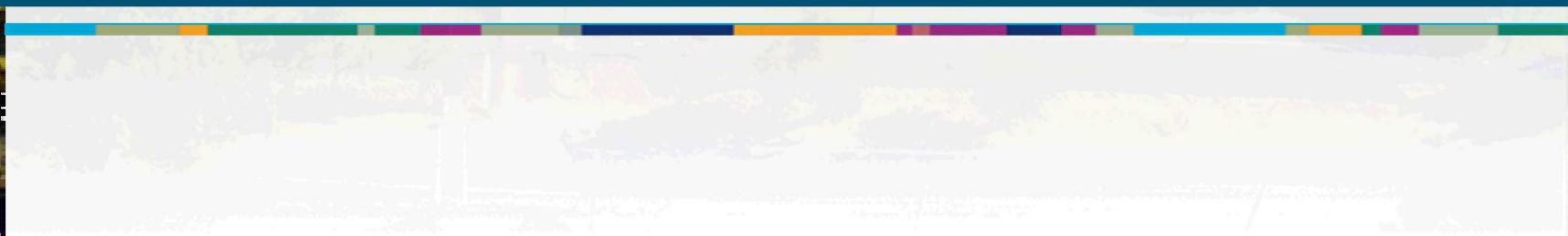
- Outputs are at a lab- to building-level
- Explore general large solution space for a large range
- Inputs can be high-level (non-specific)

Optimization Model (Scalpel)

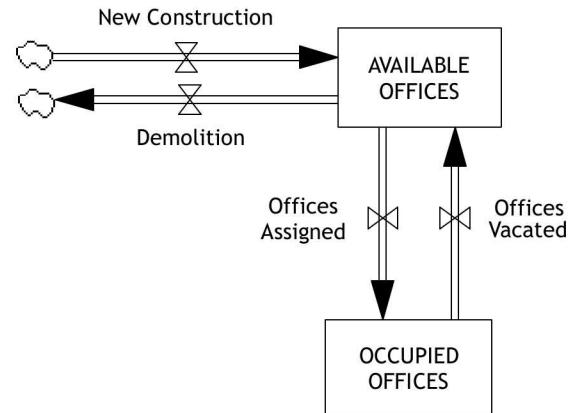
- Output can recommend specific solutions at building to office levels
- Explore specific solution parameters
- Inputs must be defined at a micro-level



Core Model Logic

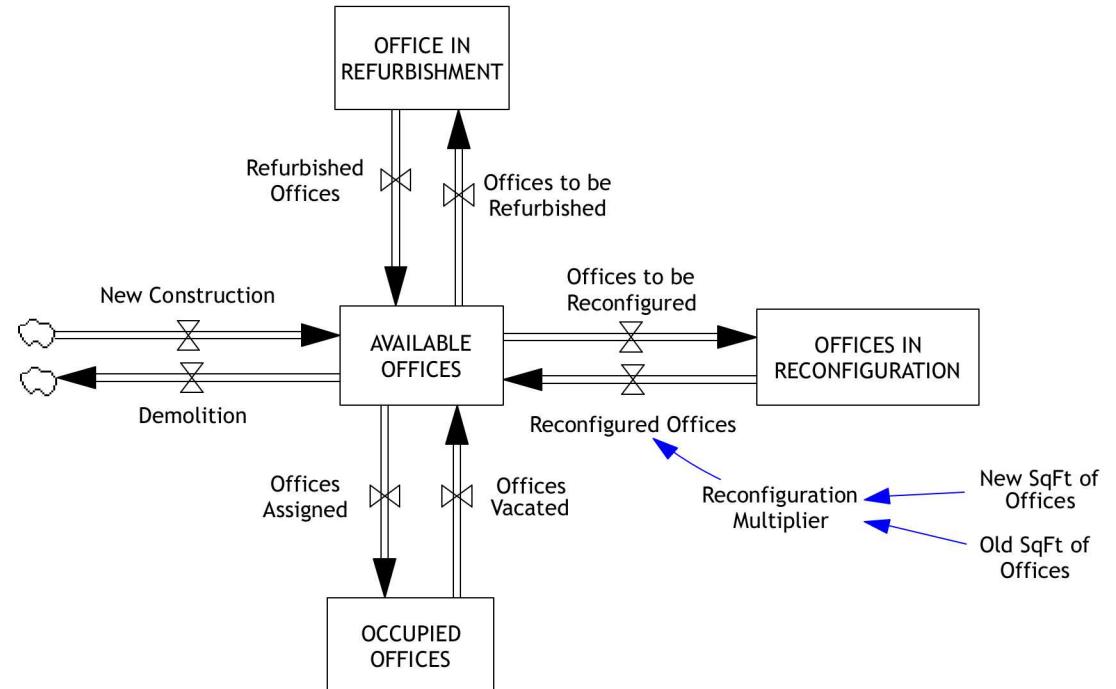


Office Space Logic: Availability and Occupancy



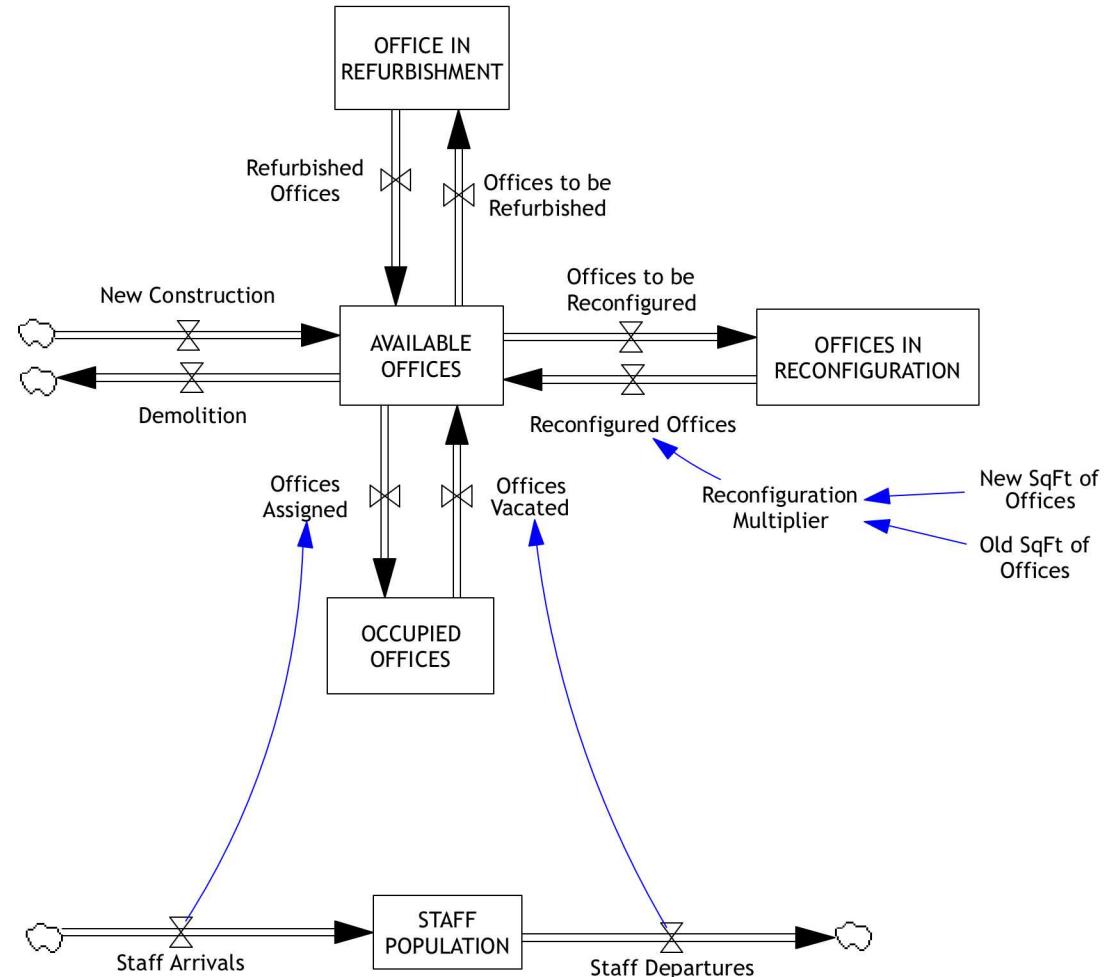
- Offices are either occupied or available.
- Office availability can change states based on office assignments and vacating.
- Offices can be added to the system through construction or removed via demolition.
- Generally speaking office buildings are vacated before being demolished, and people are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

Office Space Logic: Refurbishment and Reconfiguration



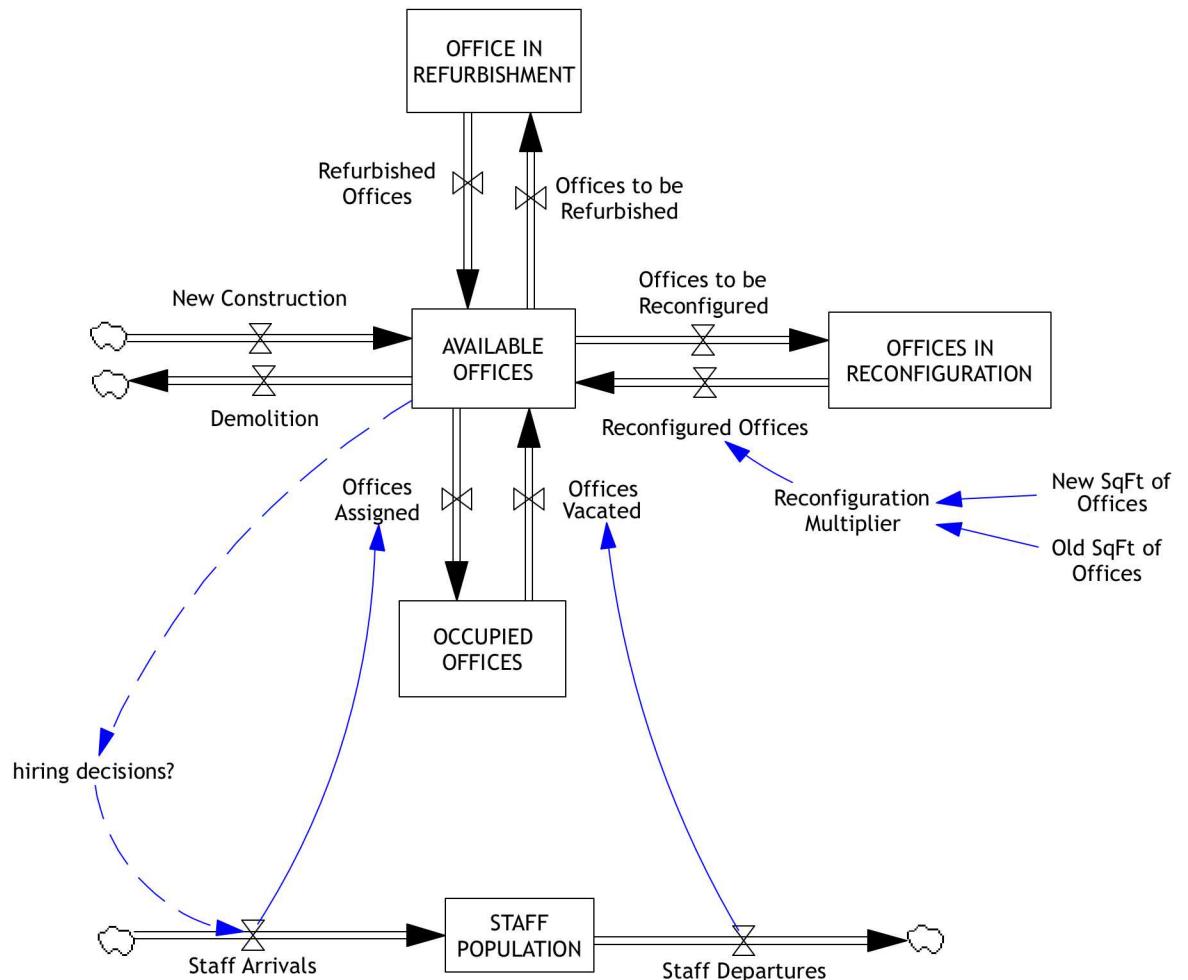
- Offices can also be reconfigured or refurbished.
- Reconfiguration changes the number of office seats available whereas refurbishment changes the quality of the space.
- While spaces are in these states, they are not able to be occupied.
- There is a time delay for each of these processes.

Staff Effects



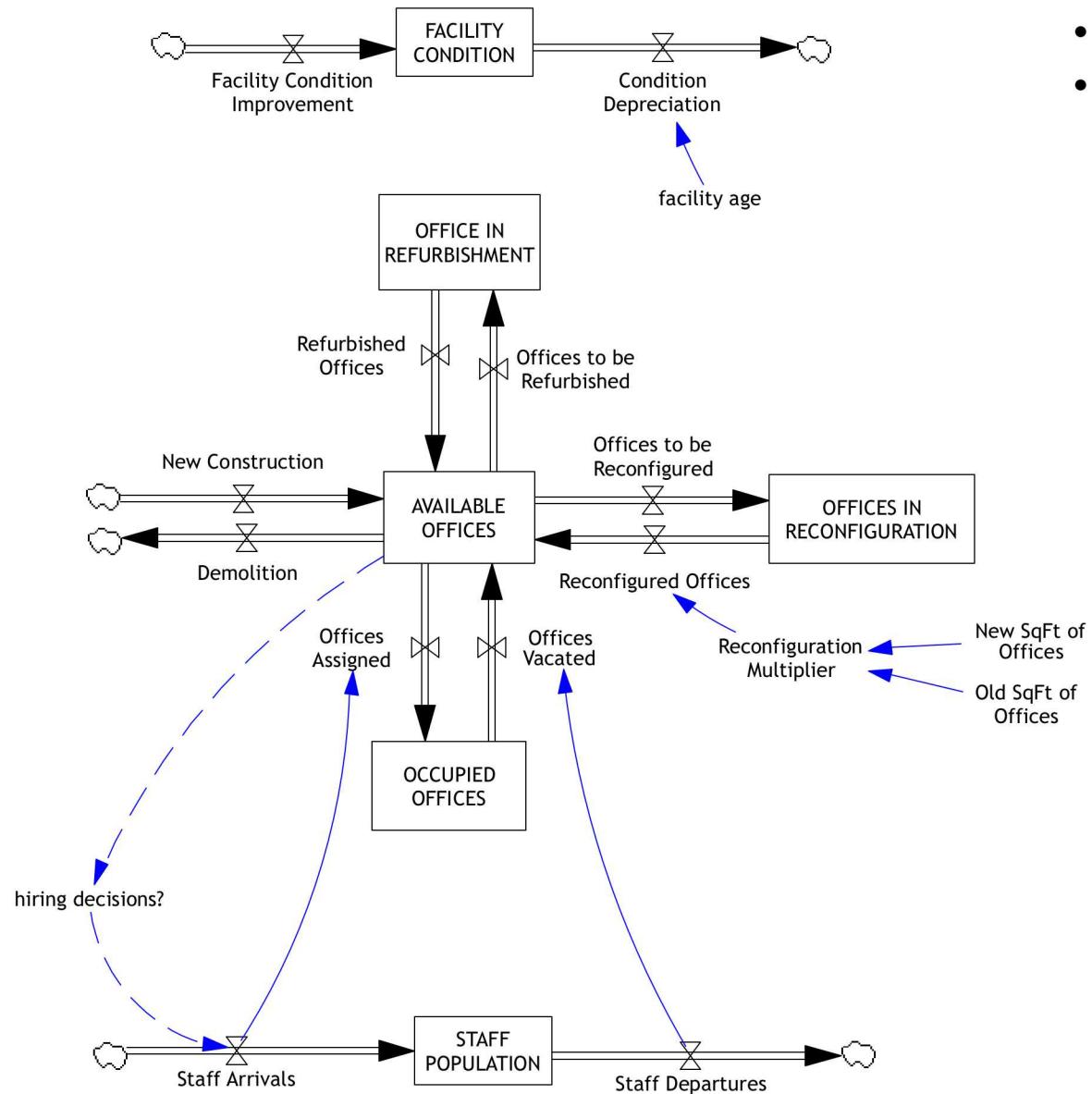
- Staffing affects the use of the office space.
- When new staff arrives they are assigned offices.
- As staff departs they vacate offices.

Does space availability affect hiring? (should it?)



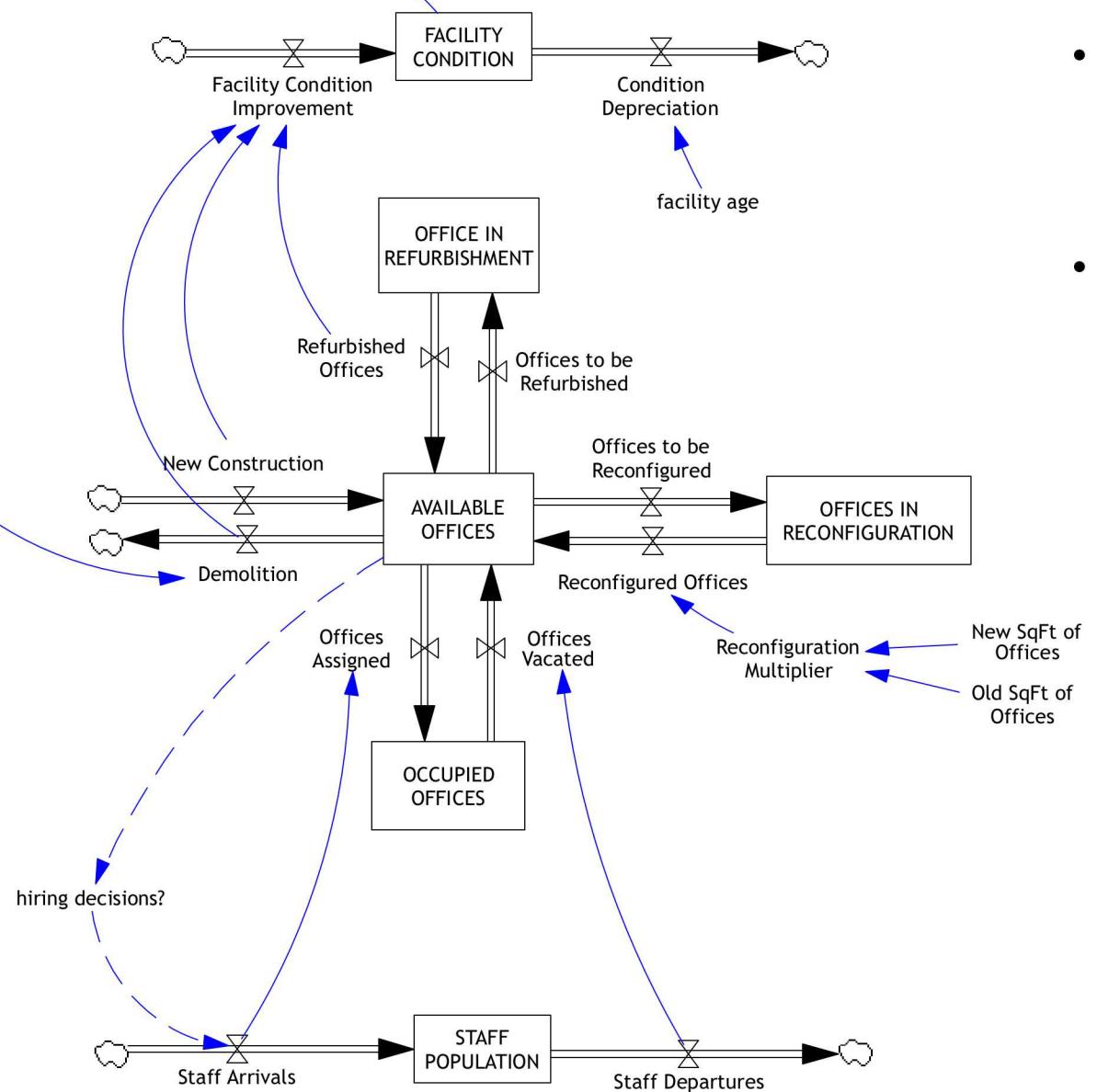
- We can theorize that the availability of offices can drive hiring decisions.
- However, hiring is controlled by a general lab-wide decisions to change the lab population.
- Decisions to hire staff are based on programmatic needs and financial capacity.
- While on a broad basis, there is a maximum capacity 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.

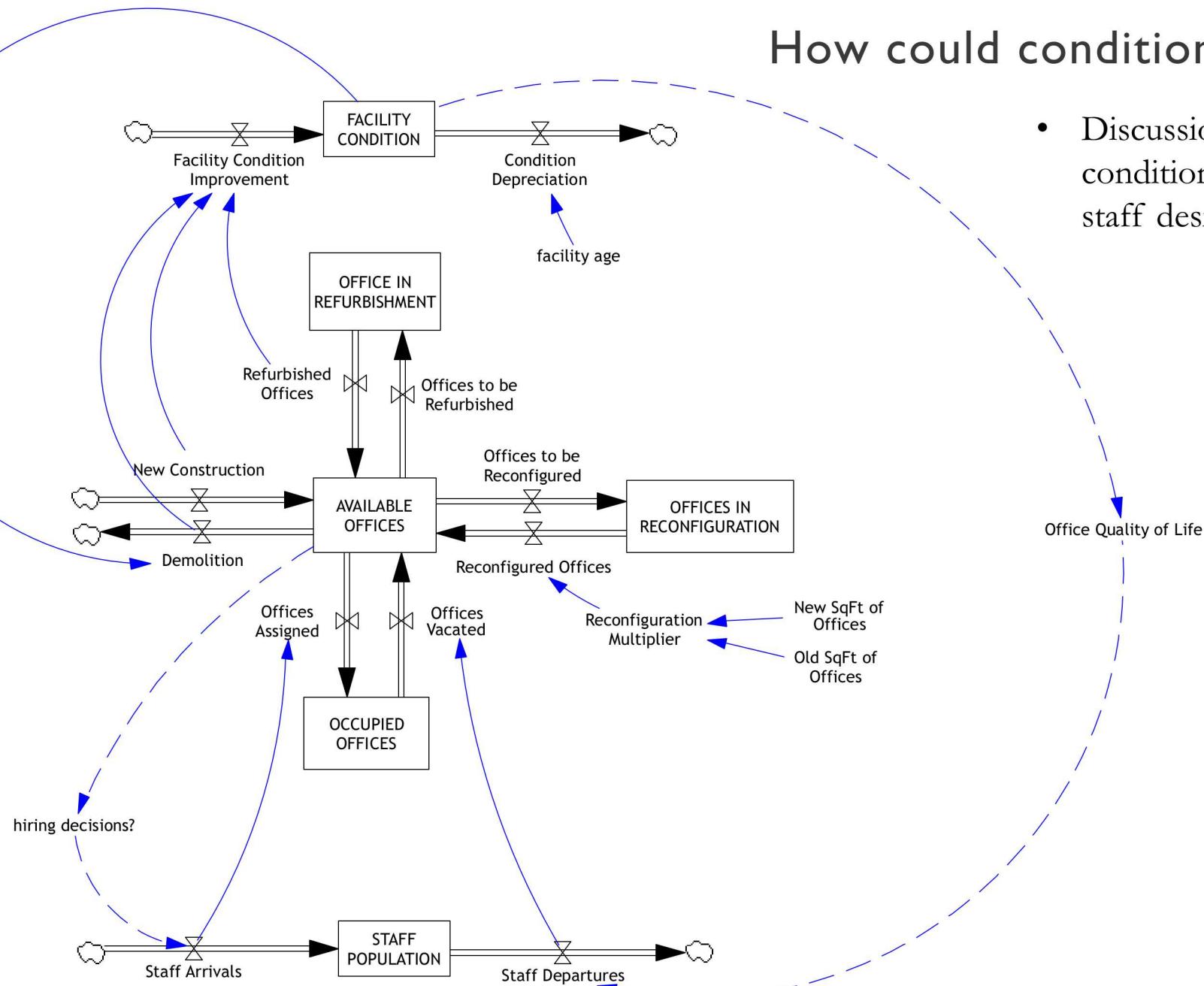
Effects on Facility Condition



- 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?

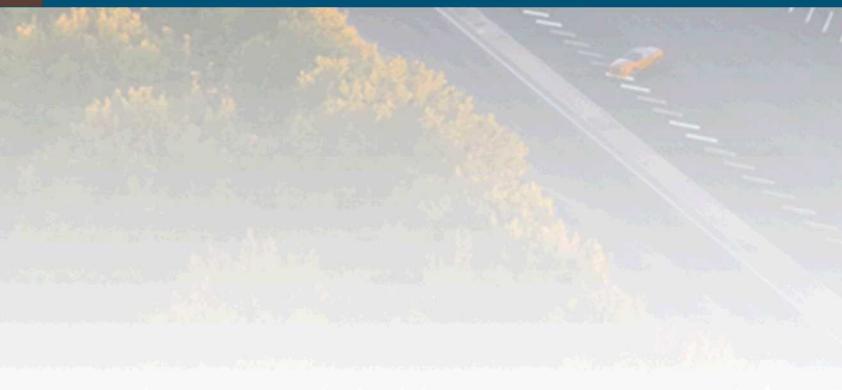
- Discussion Question: Could the condition of facilities can also impact staff desire to stay at Sandia?



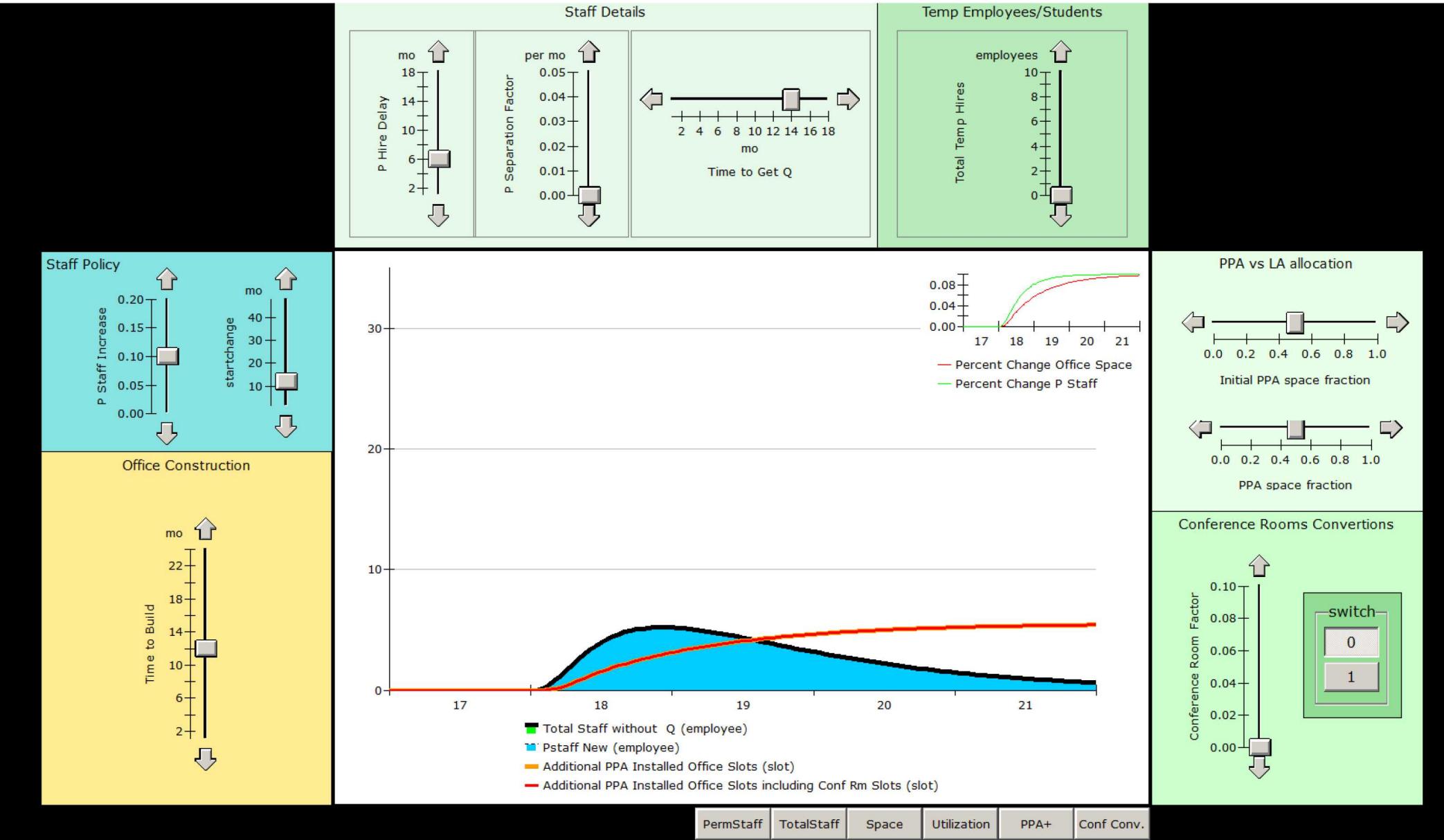
- We developed two models using this logic
 - A Thumbnail model to experiment with strategies
 - Thumbnail model has NO REAL DATA
 - Used for exploring dynamics and prototyping functionality on the larger model
 - A Full model with details to help with on the ground decision-making
 - Full model has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



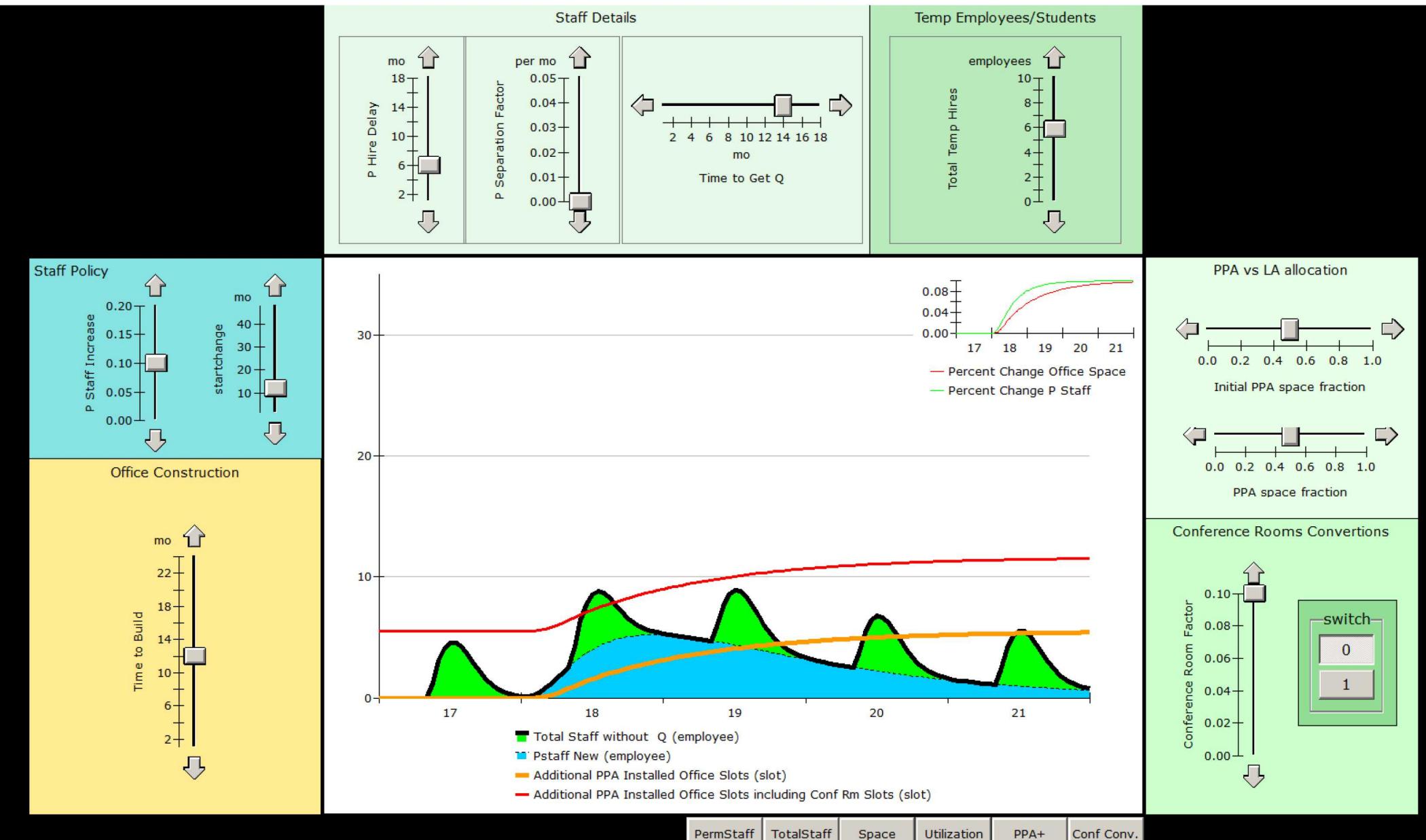
Thumbnail Model



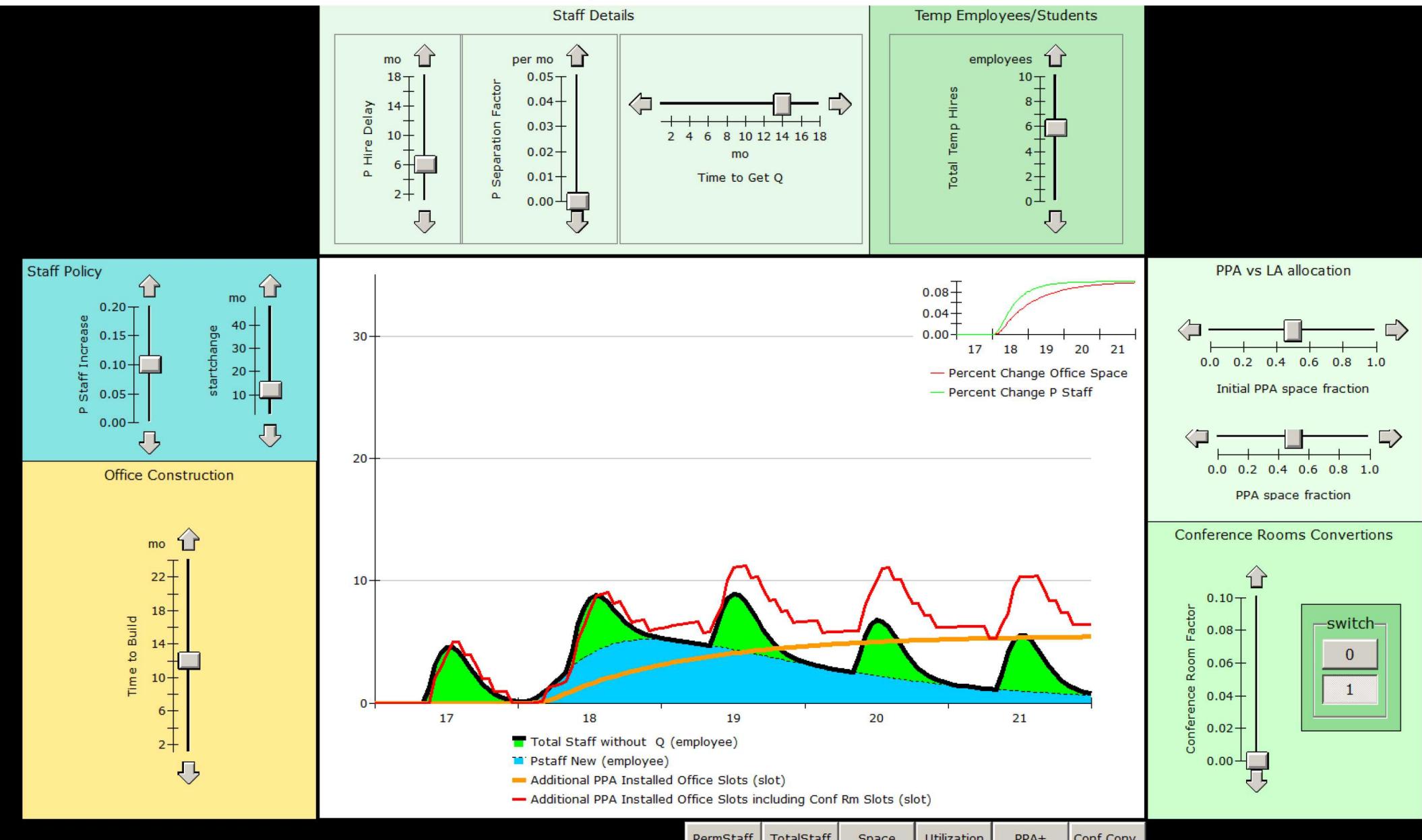
Baseline Run (Thumbnail model: Total Uncleared Staff View)



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.

Staff Inputs | NM-TA1

Space Management Model

Staff Inputs

Enter staff additions for all of NM.
Enter staff additions by each NM tech area.

% Existing Staff with Clearance 95.00 %
Time to Hire (mo) 6.00 mo
% Incoming Staff with Clearance 25.00 %
Average Clearance Time (mo) 18.00 mo

Check the box for the staff addition method that you want used by the simulation. Then, scroll down to enter the relevant details for that option.

Option 1	<input type="checkbox"/>	Add staff annually and distribute monthly based on historic 5-year average.
Option 2	<input checked="" type="checkbox"/>	Add staff annually and divide equally over the 12 months of the year.
Option 3	<input type="checkbox"/>	Simulate increase in staff positions in every month of the simulation.

Staff Additions - Option 1

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	-	-
0	0	0	0	0	0	0	0	0	0	0	0

Staff Additions - Option 2

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	-	-
0	500	150	150	150	150	0	0	0	0		

Staff Additions - Option 3

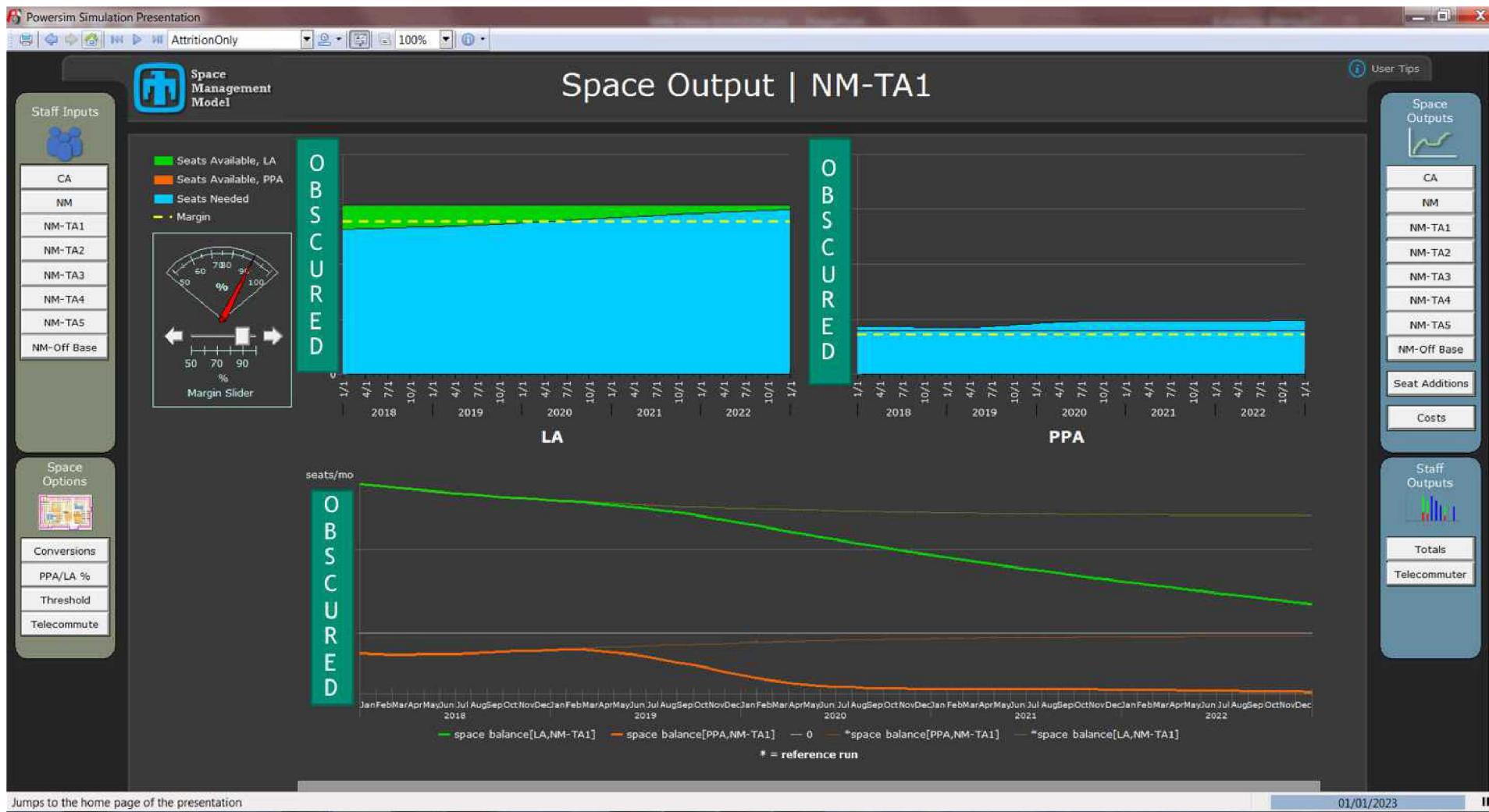
000

01/01/2018

Space Outputs

CA
NM
NM-TA1
NM-TA2
NM-TA3
NM-TA4
NM-TA5
NM-Off Base
Seat Additions
Costs
Staff Outputs
Totals
Telecommuter

- 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

File Home Insert Page Layout Formulas Data Review View Add-ins Team Design Tell me what you want to do

Cut Copy Format Painter Paste

Font Alignment Number Styles

Cells Editing

Send to MindManager Mindjet

AB1 Seats Added

A B C F K L M N P Q R S T U V Z AB AC AD AE A

1 Building BuildingKey Room Ft2 Center Org Total Occup Office Capa Satelli Resen Visito Resen Speci Furnit Under Space Type Seats Add

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 General Office-Enclosed 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

OBSCURED

OtherLeases SpaceTypeKey TechArea1 TechArea1_old TechArea2 TechArea3 TechArea4 TechArea5 Tonopah Totals

Ready Filter Mode

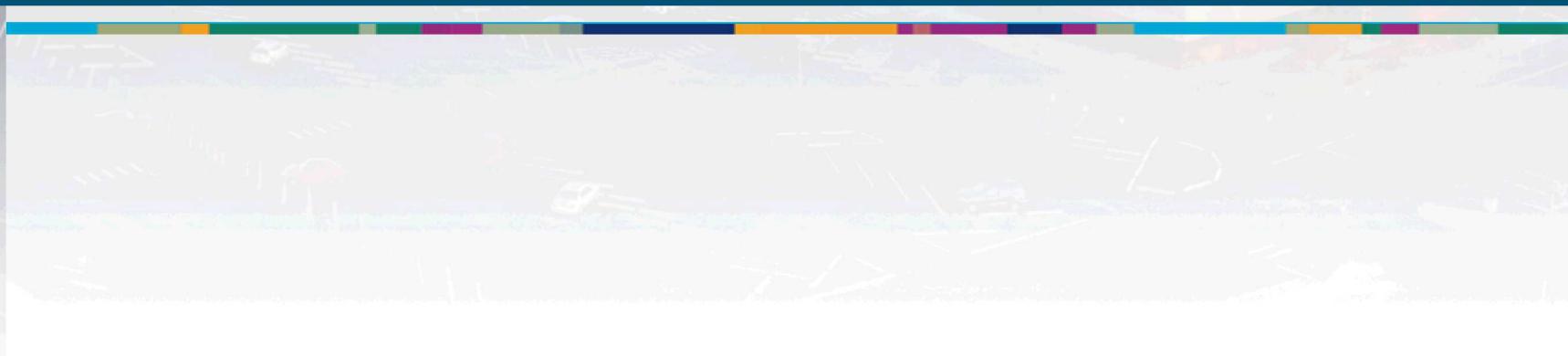
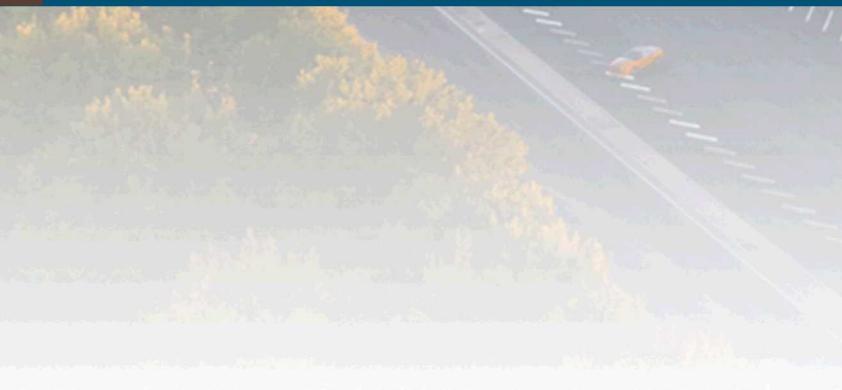
- The spreadsheet used the feed data to the model also is used to save and view seat additions by office
- The view shown here shows how many seats (green-filled column AB) were added by specific office in 823

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



Powersim Simulation Presentation
TA1_+500,150,150,150... 100% User Tips

Space Management Model

Space Conversions

PPA LA

	%	Start	Duration
Administrative Conference Room	0 %	1/1/2018	3.00 mo
Administrative Conference Room	0 %	1/1/2018	1.00 mo
Administrative Conference Room	0 %	1/1/2018	12.00 mo
Administrative Conference Room	0 %	1/1/2018	4.00 mo
Administrative Conference Room	0 %	1/1/2018	3.00 mo
Administrative Conference Room	25 %	7/1/2018	1.00 mo
Administrative Conference Room	0 %	1/1/2018	12.00 mo
Administrative Conference Room	0 %	1/1/2018	4.00 mo
Administrative Conference Room	0 %	1/1/2018	3.00 mo
Administrative Conference Room	0 %	1/1/2018	1.00 mo
Administrative Conference Room	0 %	1/1/2018	12.00 mo
Administrative Conference Room	0 %	1/1/2018	4.00 mo
Administrative Conference Room	0 %	1/1/2018	3.00 mo
Administrative Conference Room	0 %	1/1/2018	1.00 mo
Administrative Conference Room	0 %	1/1/2018	3.00 mo
Administrative Conference Room	0 %	1/1/2018	1.00 mo

Unit Cost CA

OBSCURED NM-TA1 NM-TA2 NM-T

Space Options

Conversions PPA/LA % Threshold Telecommute

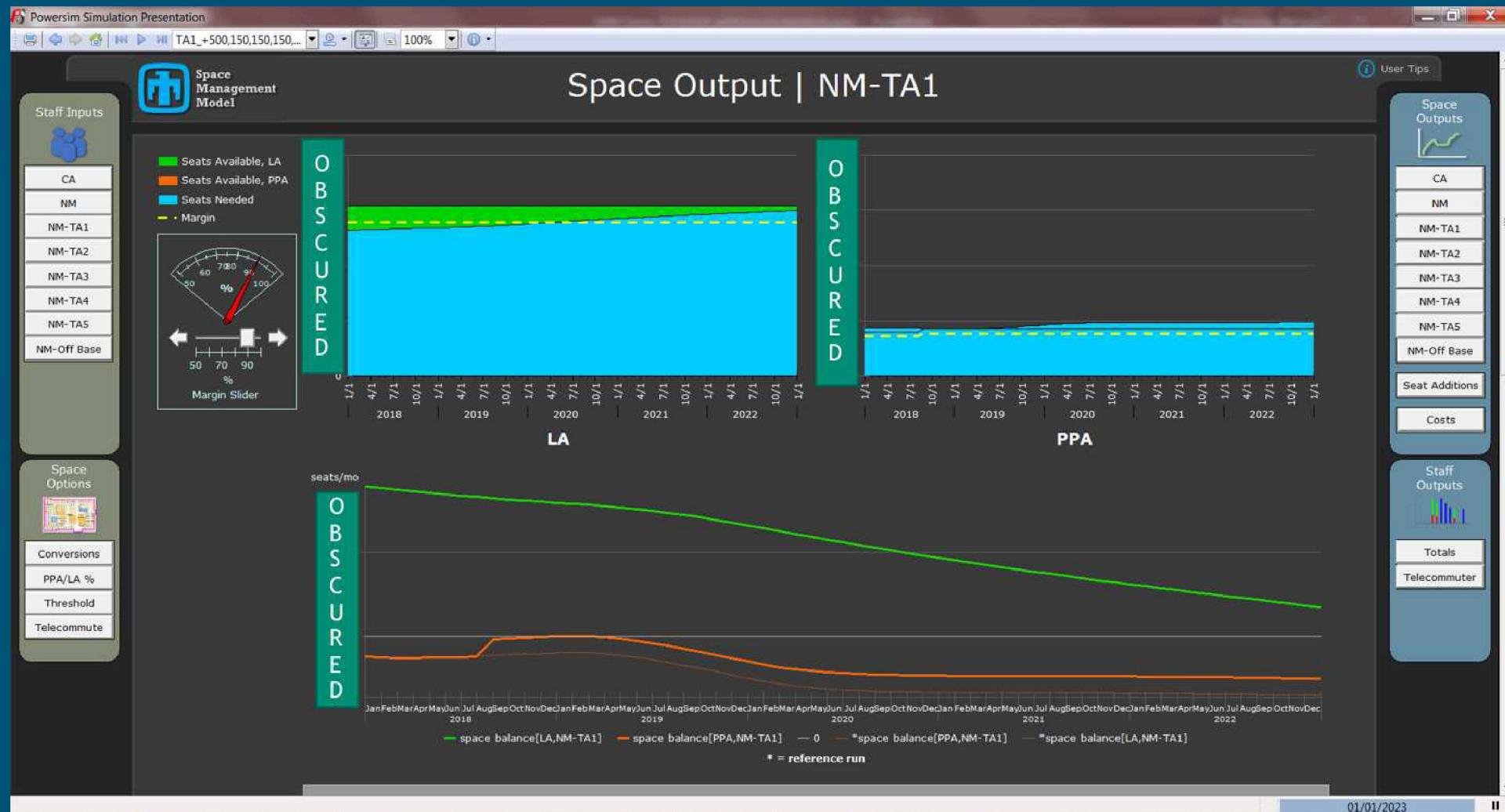
Space Outputs CA NM NM-TA1 NM-TA2 NM-TA3 NM-TA4 NM-TA5 NM-Off Base

Seat Additions Costs

Staff Outputs Totals Telecommuter

01/01/2018

- 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

Powersim Simulation Presentation TA1_+500,150,150,150... 100% User Tips

Space Management Model

Telecommuting

Staff Inputs

- CA
- NM
- NM-TA1
- NM-TA2
- NM-TA3
- NM-TA4
- NM-TA5
- NM-Off Base

Space Options

- Conversions
- PPA/LA %
- Threshold
- Telecommute

Space Outputs

- CA
- NM
- NM-TA1
- NM-TA2
- NM-TA3
- NM-TA4
- NM-TA5
- NM-Off Base
- Seat Additions
- Costs

Staff Outputs

- Totals
- Telecommuter

Staff Telecommuting

	Cleared	Uncleared
CA	0 %	10 %
NM-TA1	0 %	10 %
NM-TA2	0 %	0 %
NM-TA3	0 %	0 %
NM-TA4	0 %	0 %
NM-TA5	0 %	0 %
NM-Off Base	0 %	0 %

Staff Space-Sharing

	Cleared	Uncleared
CA	0 %	0 %
NM-TA1	0 %	10 %
NM-TA2	0 %	0 %
NM-TA3	0 %	0 %
NM-TA4	0 %	0 %
NM-TA5	0 %	0 %
NM-Off Base	0 %	0 %

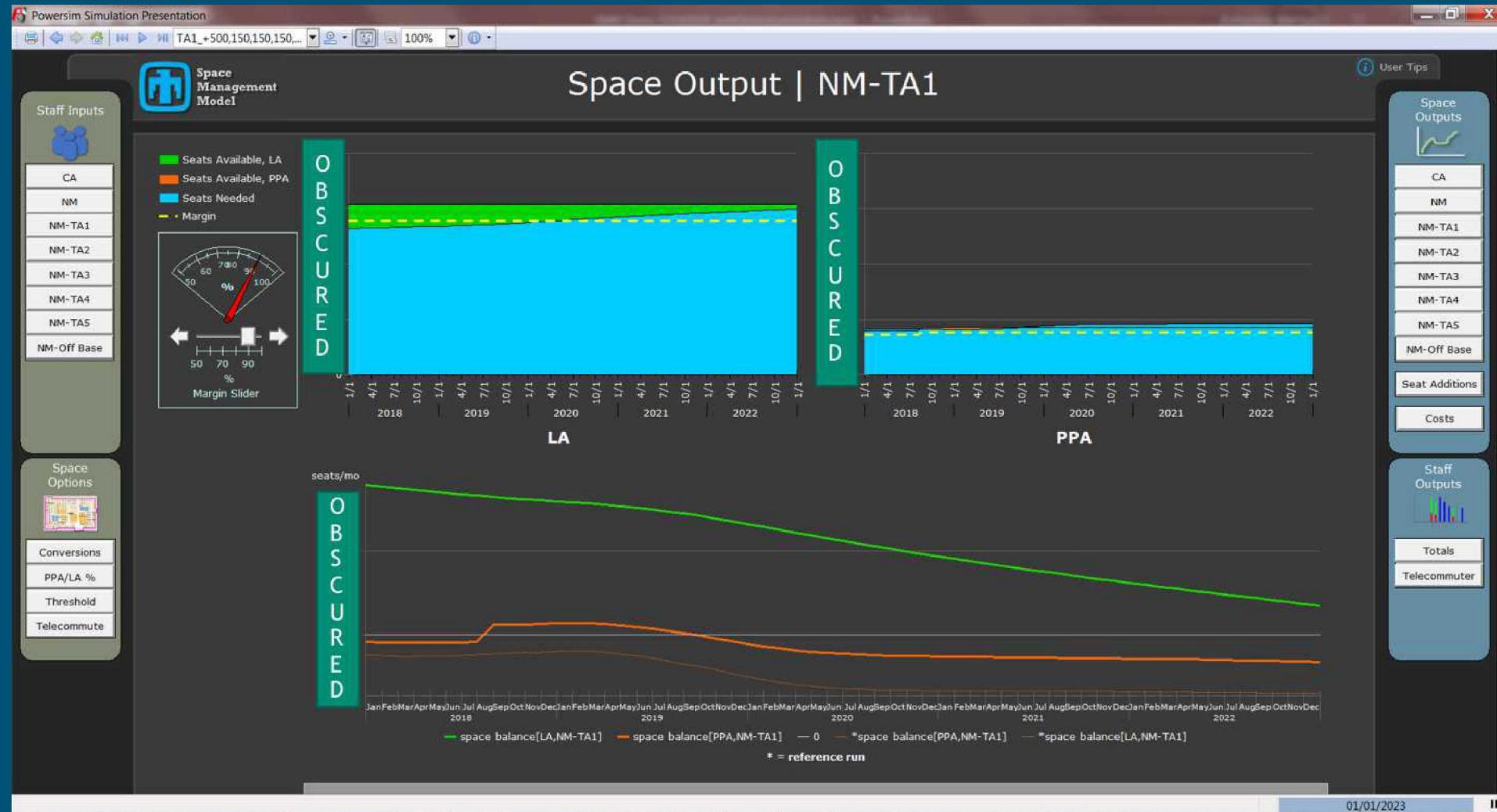
Home Office Setup Cost

OBSCURED

* A telecommuter frees up an entire office seat.
** Two space-sharers effectively act as a single telecommuter (i.e., they free up one office seat).

01/01/2018

- 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

Powersim Simulation Presentation
AttritionOnly 100% 

Office Space Threshold

Staff Inputs

- CA
- NM
- NM-TA1
- NM-TA2
- NM-TA3
- NM-TA4
- NM-TA5
- NM-Off Base

Space Options

- Conversions
- PPA/LA %
- Threshold
- Telecommute

User Tips

Space Outputs

- CA
- NM
- NM-TA1
- NM-TA2
- NM-TA3
- NM-TA4
- NM-TA5
- NM-Off Base
- Seat Additions
- Costs

Staff Outputs

- Totals
- Telecommuter

01/01/2023

Office Space Threshold Selection

Modify Sq Ft

CA	Modify	Sq Ft
NM-TA1	<input checked="" type="checkbox"/>	60
NM-TA2	<input type="checkbox"/>	70
NM-TA3	<input type="checkbox"/>	70
NM-TA4	<input type="checkbox"/>	70
NM-TA5	<input type="checkbox"/>	70

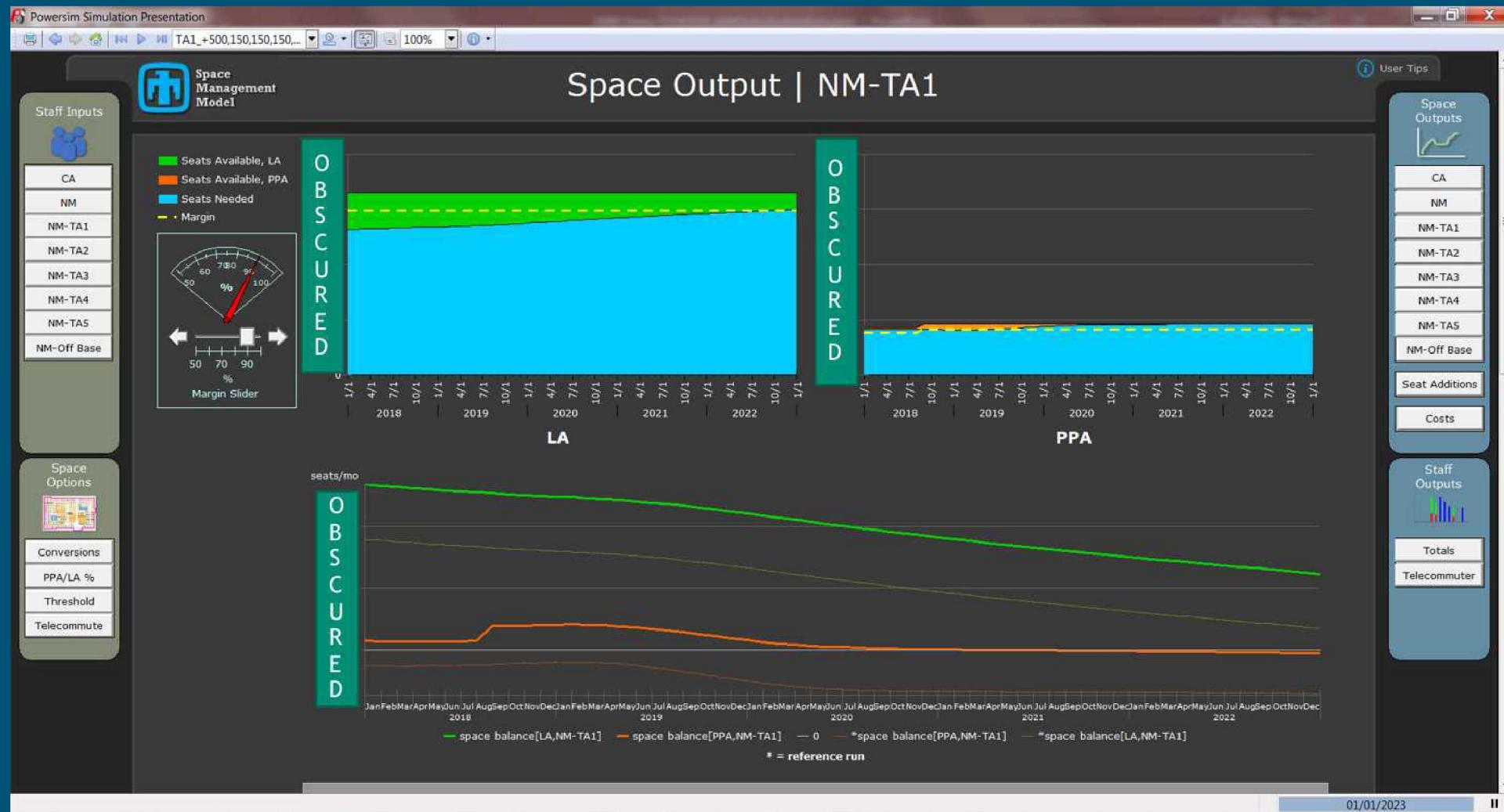
Unit Cost

	\$0.00 per seat
NM-TA1	\$10,000.00 per seat
NM-TA2	\$0.00 per seat
NM-TA3	\$0.00 per seat
NM-TA4	\$0.00 per seat
NM-TA5	\$0.00 per seat

Select buildings to apply modified Office Space Threshold to by checking boxes below. By default, all buildings are included. To view and/or modify office-level details, see spreadsheet.

California	NM-TA1	NM-TA2	NM-TA3	NM-TA4	NM-TA5
903	<input checked="" type="checkbox"/>	700	<input checked="" type="checkbox"/>	1008	<input checked="" type="checkbox"/>
904	<input checked="" type="checkbox"/>	701	<input checked="" type="checkbox"/>	1090	<input checked="" type="checkbox"/>
905	<input checked="" type="checkbox"/>	702	<input checked="" type="checkbox"/>	1091	<input checked="" type="checkbox"/>
906	<input checked="" type="checkbox"/>	703	<input checked="" type="checkbox"/>	905	<input checked="" type="checkbox"/>
910	<input checked="" type="checkbox"/>	704	<input checked="" type="checkbox"/>	905G	<input checked="" type="checkbox"/>
911	<input checked="" type="checkbox"/>	705	<input checked="" type="checkbox"/>	928	<input checked="" type="checkbox"/>
912	<input checked="" type="checkbox"/>	720	<input checked="" type="checkbox"/>	956	<input checked="" type="checkbox"/>

- Could the shortage of office seats be eliminated entirely by reducing the space threshold from 70ft² to 60ft², at a cost of \$10,000 per seat (notional cost)?
 - Walls are not torn down
 - If an office is 120ft² 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 70ft² to 60ft², 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.