“Four Modeling Questions” and Future Modeling of VHA FM Staffing

January 29, 2019

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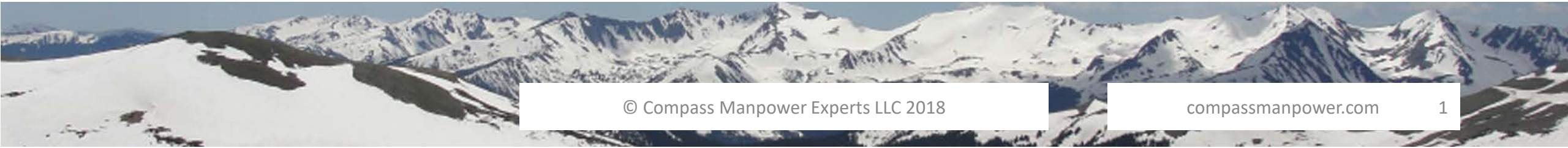

Alice's Dilemma

- "Alice asked the Cheshire Cat, who was sitting in a tree, "What road do I take?"

  The cat asked, "Where do you want to go?"

  "I don't know," Alice answered.

  "Then," said the cat, "it really doesn't matter, does it?"

Keeping the Desired Destination in Mind. Decide What We Want the Models to Be Used For, Then Create Them.

VA SOW: “to develop a comprehensive budgeting and staffing methodology that is adjustable based on site-specific characteristics and inputs”

First things first…your specific questions from the invitation

Q1: How do you determine when a heuristic model is good enough?

- I'm going to add "for manpower staffing requirements" to that
- Bluntly, I'd say when it predicts or logically explains at least 80% of your staffing needed to do the mission (that's a heuristic I like)
- But like any modeling effort, it DEPENDS…
  - On the PURPOSE of the model (for our purposes, when is it BAD enough?)
  - On the PRECISION required (what is the operational risk)
  - On what you can AFFORD (both $ to model – and COST of getting it WRONG)
  - On how MUCH of the population's workload to FTE it adequately explains
  - On whether you want to accommodate more of the true distribution or fit
  - How straightforward is it to apply and … is it useful??

Example of Heuristics or "Rules of Thumb" Approaches - Ratios

- (2010) IFMA/ASHE staffing benchmarks for healthcare facilities of all types:
  - 1 electrician per 213,000 GSF (gross square feet)
  - 1 plumber per 484,000 GSF
  - 1 controls and low voltage per 600,000 GSF
  - 1 HVAC and Central Plant per 283,000 GSF
  - 1 carpenter per 496,000 GSF
  - 1 Generalist per 124,000 GSF
- Homework:
  - Have you already gathered the data VHA-wide or for a region and examined what ratios -- "good or bad"-- presently exist and compare to these?

More on Heuristic / Deterministic / Stochastic Modeling Choices

- When you have NOTHING in place, a “crawl – walk – run” spiral of model development is the way to go
- Do the “rules of thumb” based upon ratio and benchmarking first
  - You start to understand your system and what drives the most work
  - You get something in place – but don’t have to make mandatory, just a guide at first
- Go to more accurate workload/man-hour staffing development next
  - Look for potential workload factors – things you can count that drive workload
  - Be prepared to do some measurement – what data do you already collect?
- Do the “high powered” or “in the weeds” measurement or advanced stochastic computer modeling where it’s worth the bang for the buck
- Use the modeling approach that best fits the situations and work centers

Modeling Advice from E.P. Box, Statistician

- Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful
- Just as the ability to devise simple but evocative models is the signature of the great scientist so overelaboration and overparameterization is often the mark of mediocrity
- Discovering the unexpected is more important than confirming the known
- Management must provide employees with tools that will enable them to do their jobs better, and with encouragement to use these tools. In particular, they must collect data…

Q2: Can you have several models with different structures, even bases, for different groups of staff?

- Of Course – what would keep an organization from such flexibility?
- It is normal to use a mix of tools to quantify different work centers
- There is nothing that stops you from them "bundling" these models into something to depict the whole requirement
- Example:
  - Fixed staffing (chief of office XYZ)
  - Widget or transactional staffing based on some production level
  - Minimum essential shift staffing (guards/vigilance/watch teams)
  - Staffing pattern – ratio of X indirect workers to support the operational teams
  - Variances – situations where you add/delete/modify tasks and processes for specific location unique situations beyond the "core" manpower model

Q3: How do you know what level of aggregation is "best" for a model: individual departments, groups of departments, whole organization?

- Similar to the previous answer, when it works for your purposes
- I like to create models to fit the local base where the staff can be used without relocation …
- Some functions may be "shared services" that can be located anywhere, but service a population or mission remotely
- You can "roll up" the results to higher levels of aggregation to look at a whole function at a location, region, or enterprise-wide
- Ideally, you would like to look at the total requirements nation-wide for budgeting and workforce planning purposes

Modeling “Best Practices” for the Future

Future Trends in Facility Management Will Drive New Models

- "SMART" Facilities and "The Internet of (Health) Things (IoHT)
  - Compare what has happened to "IT" and Cyber / self-diagnosing, etc. /mobile aps
- End-to-end real estate delivery model to facilities operations
- Installation or Facility Health Assessments
  - Tie eBuilder and/or BUILDER to needed maintenance
- Advanced Facility/Maintenance Management Systems
- Accreditation, Certification, Standards, Regulatory Requirements
- Seeing FM role as an "operational partner" in delivering good outcomes for patients/veterans rather than "just a cost"

Future Trends in Staffing Models

- Leveraging “Big Data” and Data from “Building Management Solutions”
  - Lots of Benchmarking at our fingertips
  - “Machine Learning” where we can see things that can become the model or dramatically yield means to examine multiple locations
  - Harnessing the insight of observing so much – even “digital views” of facilities
- The “rebirth” of Manpower Modeling – driven by demand and facilitated by a new generation of analytical tools and apps and “boutiques”
  - Price-tagging tied to future performance /risk– more agility/real-time/predictive
- The Changing Workforce Available
  - Fulltime/Part-time/Seasonal/Temp/Term/At-Will/Job-Share/Independent Contractors/Freelancers/Subcontractors/Capability Contracted as a Service
- Using the Models within your Planning/Programming/Budgeting System – AND HR Lifecycle AND Training
  - Manpower models of little use without acknowledged framework

Questions?

Backup: Ratios of X Skills to GSF

- FICM - 3.2.1 Gross Area (Gross Square Feet—GSF)
  - https://**nces.ed.gov**/pubs2006/ficm/content.asp?ContentType=Section&...
  - 3.2.1 Gross Area (Gross Square Feet GSF) Definition. The sum of all areas on all floors of a building included within the outside faces of its exterior walls, including all vertical penetration areas, for circulation and shaft areas that connect one floor to another. Basis for Measurement.

Modeling Considerations For Study of Veterans Health Administration Medical Facilities

September 27, 2018

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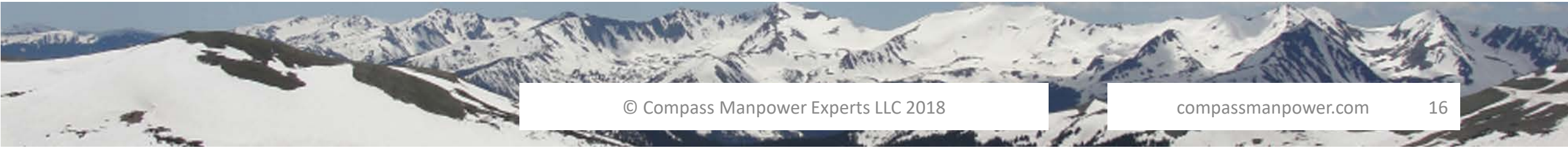
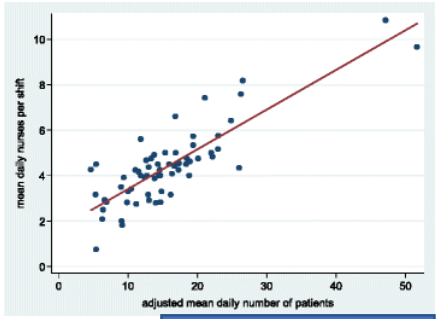


MODELING: What are we talking about?

- Model: A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.

- Mathematical Model: A series of mathematical equations or relationships that can be discretely solved.



Y=mx+b

- Manpower or "Staffing Requirements" Model: A tool made up of one or more mathematical equations and/or logical relationships that represent a system. It is used to calculate an expected level of manpower needed to generate an estimated level of required workload.

"ALL MODELS ARE WRONG; SOME MODELS ARE USEFUL" – Attributed to George E.P. Box

PURPOSE TO INVEST IN "MODELING":

Workforce and Budget Planning

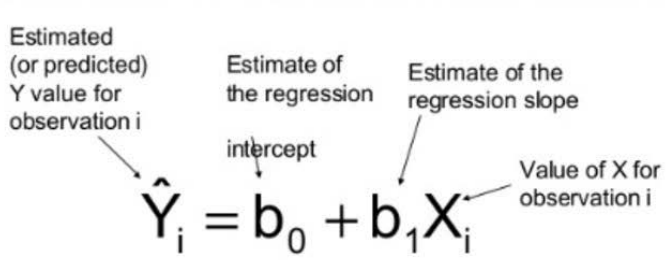
- Creating within VA means to provide the right number of FTEs, with the right skills, in the right jobs, at the right time

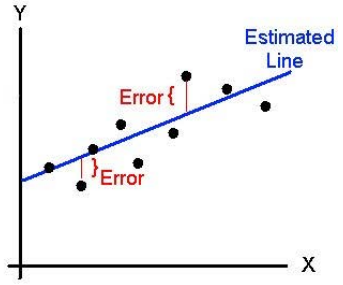
Workload Analysis -- A part of Workforce Planning

- To deliver the necessary staffing to maintain systems that support delivery of VA's core missions
- To help standardize level of service and bring increased performance in the years ahead
- To objectively define, budget for and employ some of VA's most expensive resources: people … and the critical mission infrastructure they maintain

A “USEABLE” MODEL WILL:

- Have characteristics to make it relatively easy to employ
- Provide credible information to support decision makers
- Provide consistent results when applied across a set of similar circumstances
- Be easy to adapt when changes occur, and
- Be easily understood by people outside the development team





Source: USAMAA White Paper

UN-USEABLE MODELS:

- Only apply in a very narrow set of circumstances
- Use a mathematical equation that does not logically match the business process
- Require so many input variables that they become cumbersome to use, and difficult to understand, or
- Are subject to too much randomness

$$
\begin{aligned}
\mathrm{d}\alpha_i(t) = \lambda_{\mathrm{B}} &\left(H_i^{\alpha}\,\mathrm{d}t + \sum_j L_{ij}^{\alpha\alpha}\alpha_j(t)\,\mathrm{d}t + \sum_{jk} B_{ijk}^{\alpha\alpha\alpha}\alpha_j(t)\alpha_k(t)\,\mathrm{d}t \right) \\
&+ \lambda_{\mathrm{A}}^2 \sum_j \tilde{L}_{ij}^{(2)}\alpha_j(t)\,\mathrm{d}t + \lambda_{\mathrm{A}}\sqrt{2}\sum_j \sigma_{ij}^{(2)}\,\mathrm{d}W_j^{(2)} \\
&+ \lambda_{\mathrm{M}}^2 \left(\sum_j \tilde{L}_{ij}^{(3)}\alpha_j(t)\,\mathrm{d}t + \sum_{jkl} \tilde{M}_{ijkl}\alpha_j(t)\alpha_k(t)\alpha_l(t)\,\mathrm{d}t \right) \\
&+ \lambda_{\mathrm{L}}^2 \left(\sum_j \tilde{L}_{ij}^{(1)}\alpha_j(t)\,\mathrm{d}t \right) + \lambda_{\mathrm{M}}\lambda_{\mathrm{L}} \left(\tilde{H}_j^{(1)}\,\mathrm{d}t + \sum_{jk} \tilde{B}_{ijk}\alpha_j(t)\alpha_k(t)\,\mathrm{d}t \right) \\
&+ \lambda_{\mathrm{A}}\lambda_{\mathrm{F}}\tilde{H}_j^{(2)}\,\mathrm{d}t + \sqrt{2}\sum_j \sigma_{ij}^{(1)}(\alpha(t))\,\mathrm{d}W_j^{(1)},
\end{aligned}
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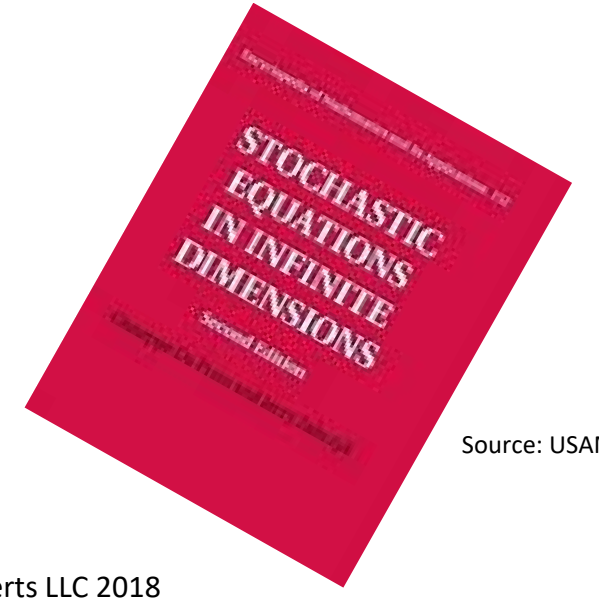


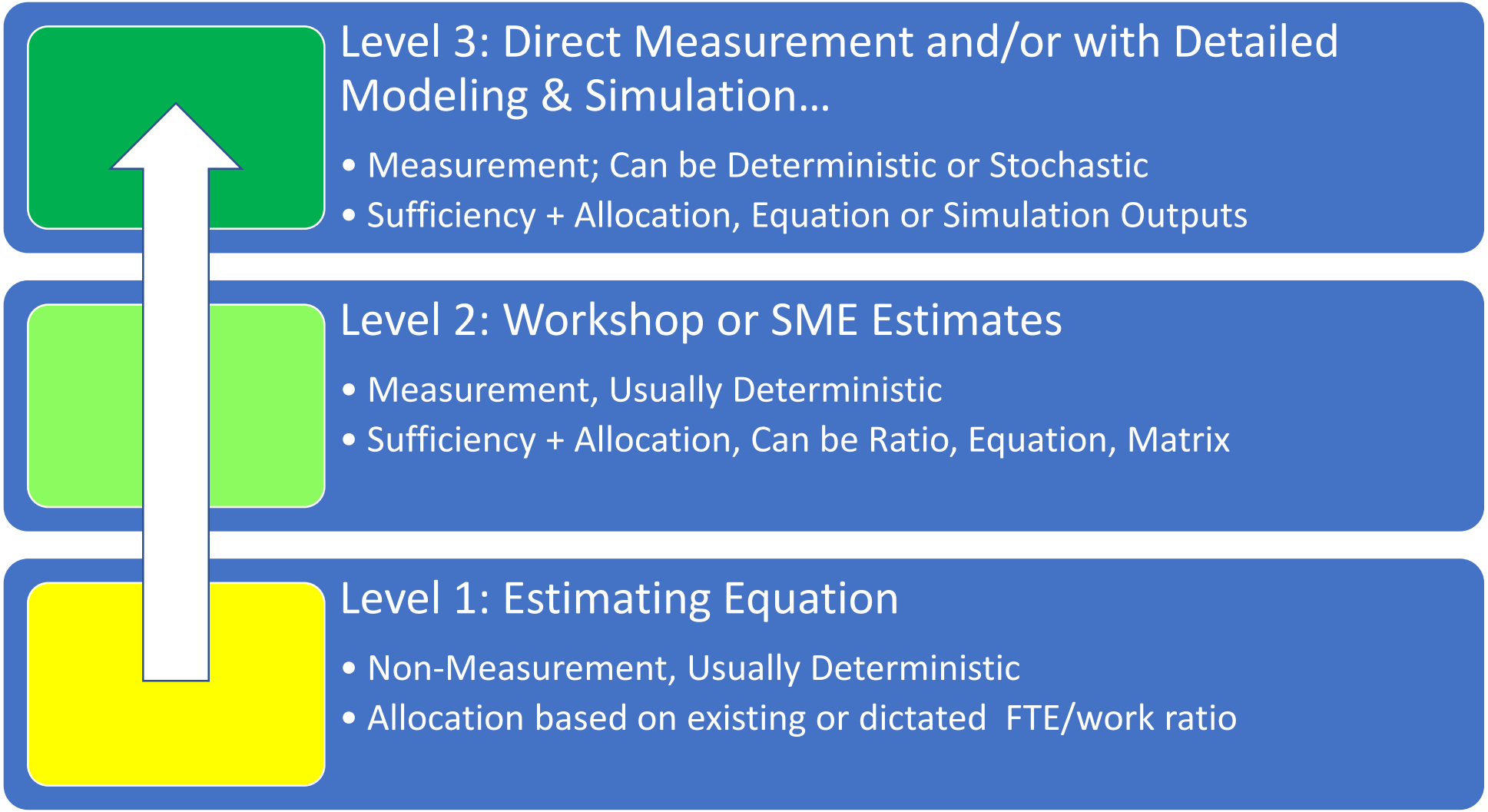
Source: USAMAA White Paper

A *USEFUL* MODEL WILL:

- Generate results that add value to the overall decision making process, and
- Provide a clear understanding of the cause and effect relationships between workload and the manpower necessary to produce it.

Source: USAMAA White Paper

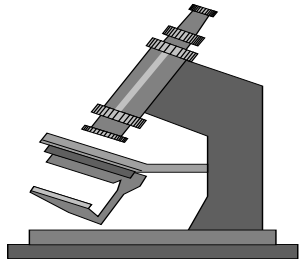
THREE LEVELS OF MODEL SOPHISTICATION



EXAMPLE CRITERIA TO SELECT MODELING METHODOLOGIES

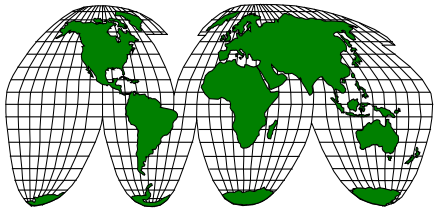
Cost to Develop/Apply/Maintain

Cost Surface



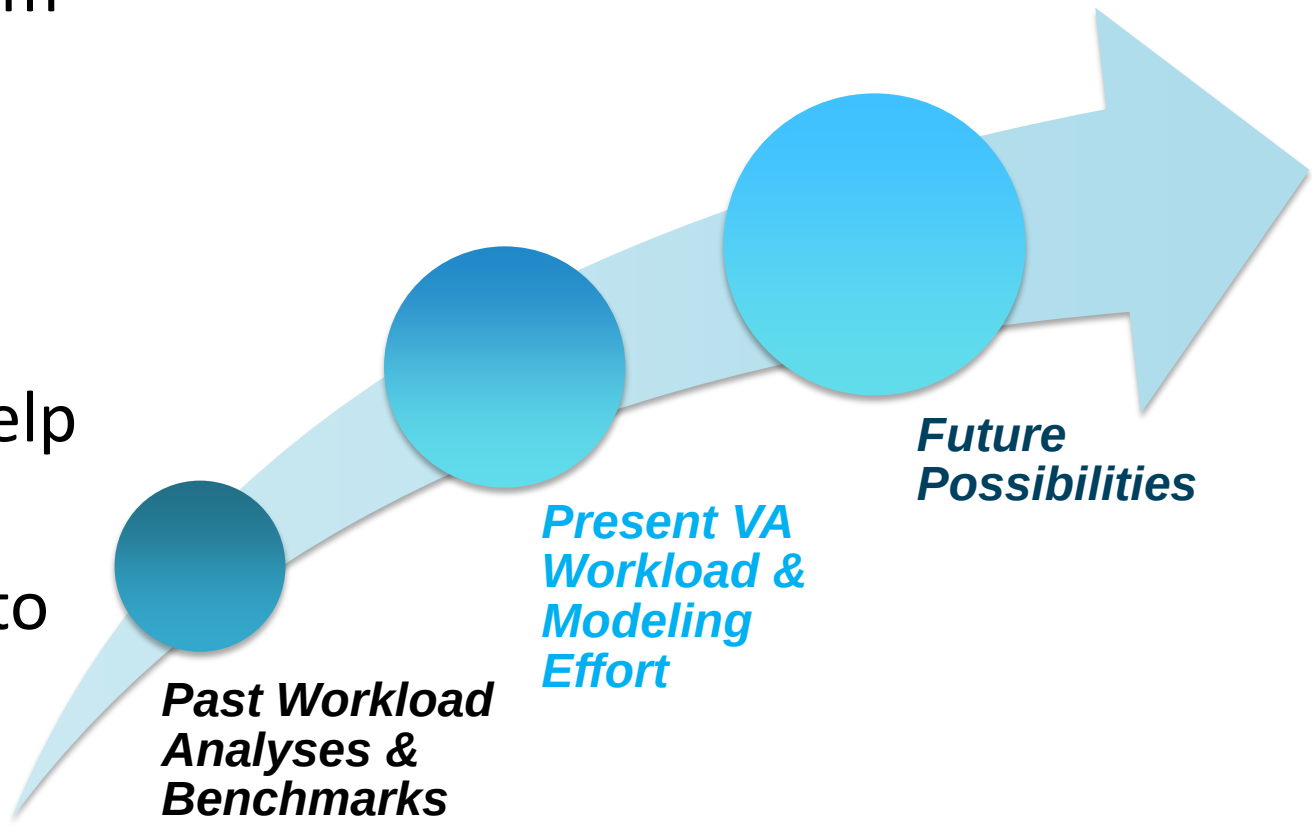
Level of Detail, Accuracy, Credibility, and Defensibility

Coverage



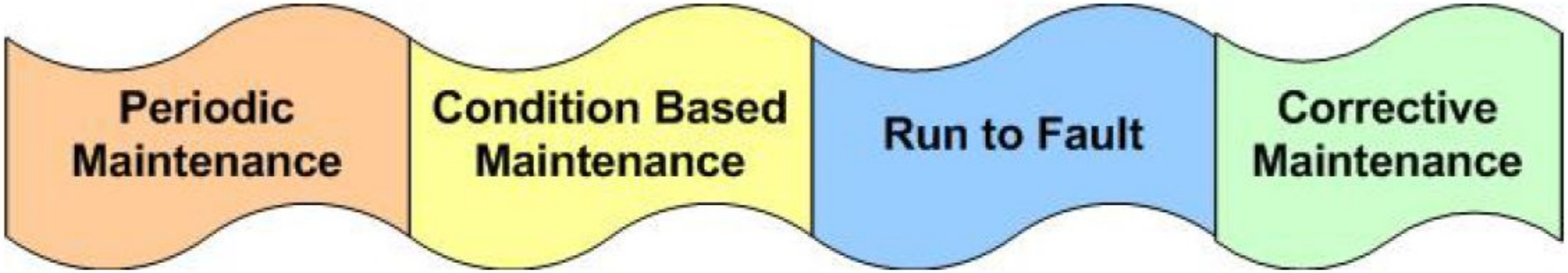
STRATEGIC CONTEXT

- VA seeking to implement many concurrent reforms and system improvements in a resource-challenged environment
- Studying VA Facilities O&M mission outputs and human resource requirements can help allocate resources to need
- Previous efforts can be used to help in this journey



HOW WE MAINTAIN DRIVES WORKLOAD… AND IMPACTS ON OPERATIONS

Reliability Centered Maintenance (RCM)



Periodic Maintenance (PM)
- *Safety related checks*
- *Preventive maintenance inspections*
- *Performance checks and routine maintenance*

Conditioned Based
- *Time-Based actions*
- *Cycle-Based actions*
- *Predictive Analysis and Intervention (PAI)*

Run-to-Fault (RTF)
a conscience decision to accept the risk of a facility problem or failure.

Corrective Maintenance is employed after a failure or to correct a problem.

"Big Data" and Tech Today Enables more PREDICTIVE APPROACHES – to Anticipate/Plan Actions

YOU ARE NOT ALONE: FINDING BENCHMARKS

- OTHER FEDERAL CAMPUSES
- PRIVATE SECTOR / INDUSTRY / FOR-PROFIT HEALTHCARE SYSTEMS
- VOLUNTARY / NON-PROFIT HEALTHCARE SYSTEMS
- ACADEMIC INSTITUTIONS / UNIVERSITIES
- PROFESSIONAL ASSOCIATIONS: IFMA, ASHE, APPA, etc.
- PROFESSIONAL / ACADEMIC RESEARCH & PUBLICATIONS
- INDUSTRY EXPERTS / CONSULTANTS

Recommendation: Also Perform your own Baseline and Benchmark Assessment

What's the situation today?

- BACKLOG or DEFERRED WORK
  - Some is good; a LOT is probably not. Can we clearly define the backlog?

- USE OF OVERTIME
  - Is "Overtime" normal in these work centers? How much? Why?

- USE OF SHORTCUTS or deviations from directed practice
  - How often do workers resort to "creatively accomplishing" the jobs?
  - Should those actions be recommended as "innovations" or should we return to standard practices to reduce risk?

Other Key Staffing Model Considerations

- Potential Workload Factors /Drivers
  - Try a lot of these – but you may not need to specifically incorporate all of them into the models! (not all are “significant”)
- Great models can be built with great data:
  - Data Systems, Data Quality and Availability
- Take time to gather solid baseline data
- Staffing Ratios – wonders and the pitfalls – but great starting point
- Cost and Risk considerations – what happens if we do/don’t maintain
- As-Is Modeling vs To-Be Modeling…are we doing the right things now in the best way?

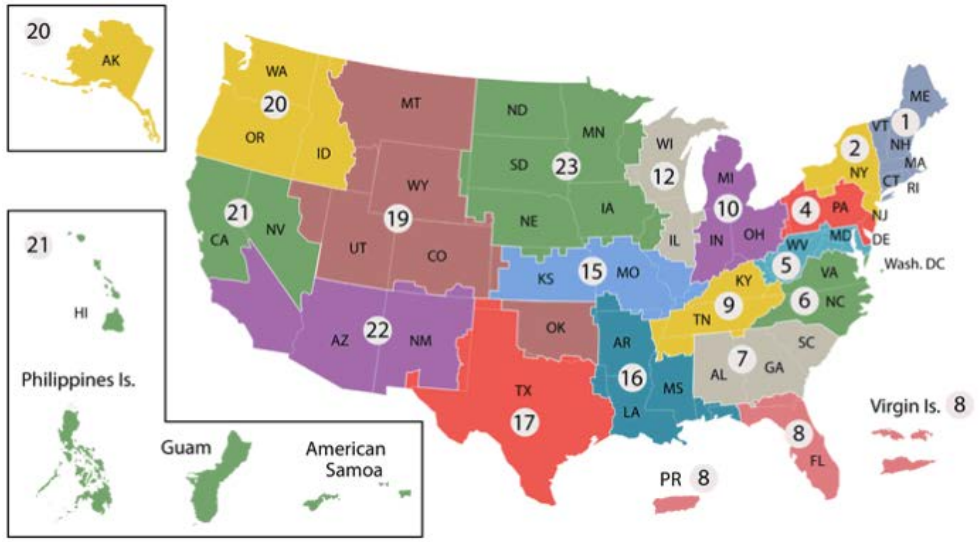
OUTPUTS

- Workforce Expressed in Man-hours or Full-Time Equivalents
- Decision Points for: 1) In-House; 2) Overtime; 3) Contract FTEs
- Labor Skill Types and Levels (Electrician/Plumber/Mechanical/etc.)
- At Least three general Labor Pools: 1) Professional & Office; 2) Skilled Trades; 3) General Labor/Custodial/Cleaning
- Activities: Routine/Major/Minor

Categorize and Prioritize the Differing Elements and Functions You Want to Study

WHERE SHOULD THE WORK BE PERFORMED? (AND STUDIED…)

- Per Facility
- Per Campus
- Geographic /Regional
- Travel Teams
- Shared Services
- Centralized Services
- Outsourced



Clearly Define Scope: What's In – What's Out – and take in parts

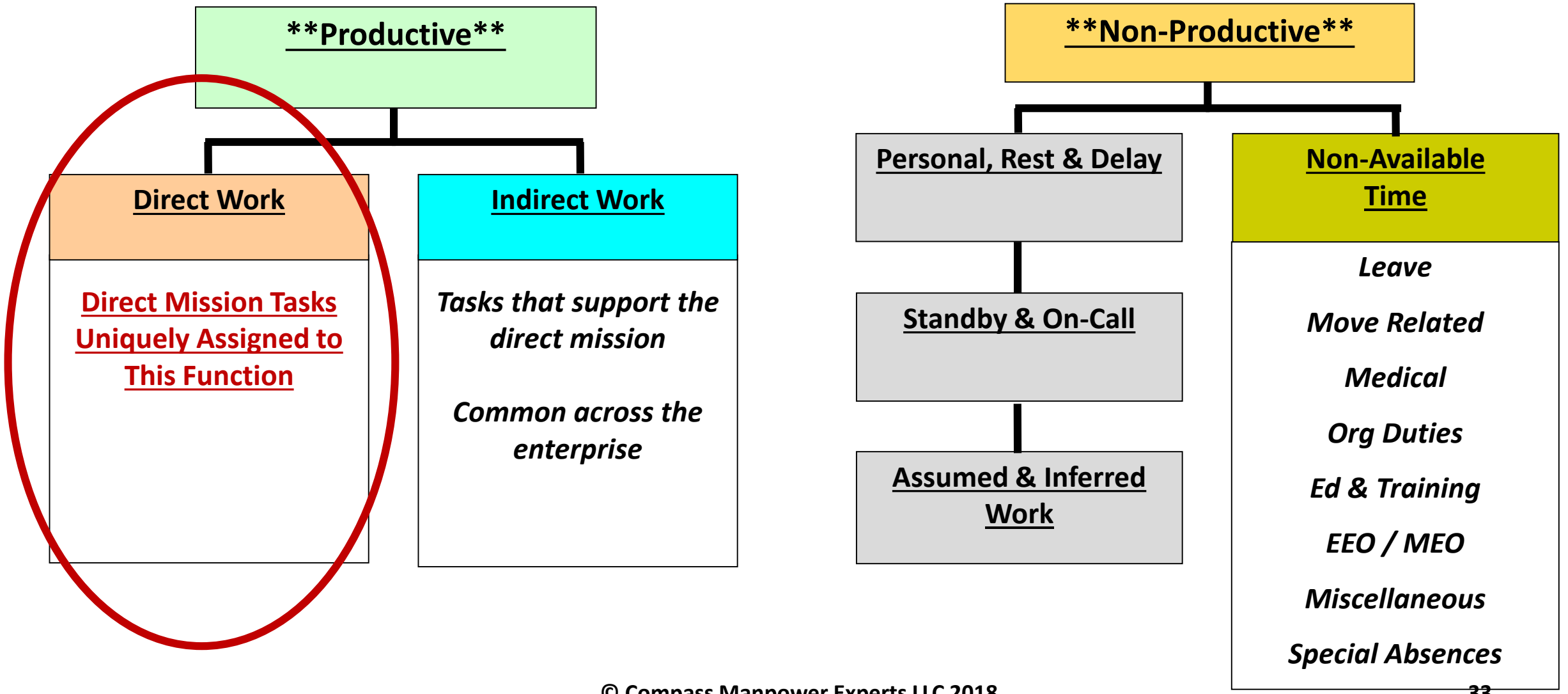
- Headquarters or "Corporate" Level Activities
- Management / Project Planning, Construction Oversight / Reporting / Budgeting /Environmental / Real estate/Property
- Routine Maintenance
- Facility Operations (Boilers, Power Production, Climate / Lighting etc.)
- Custodial / Cleaning / Grounds Keeping / Pavements
- Painting, Touch up
- Construction / Reconstruction / Renovations / Moves
- Maintenance Supplies, Equipment, Parts
- Furnishing Mgt / Fixtures / Art
- Medical Systems Calibration and Maintenance (Imaging, Labs, O2, etc.)

WHAT'S INCLUDED IN AN FTE?

- TOTAL TIME -- AVAILABLE TIME -- NON-AVAILABLE TIME
- HOW MANY HOURS A WEEK -- MONTH -- YEAR?
- ANNUAL LEAVE -- MEDICAL -- TRAINING -- PARENTAL
- 168 vs 150 vs ??? HOURS / MONTH
- OVERTIME -- COMP TIME
- UTILIZING PART-TIME vs FULL-TIME
- HOURLY PRODUCTIVE TIME (JOB PLANNING, ETC)
- ON-CALL and STANDBY (and COMPENSATED vs UNCOMPENSATED)

FTE *DOES NOT EQUAL* "HEAD COUNT"

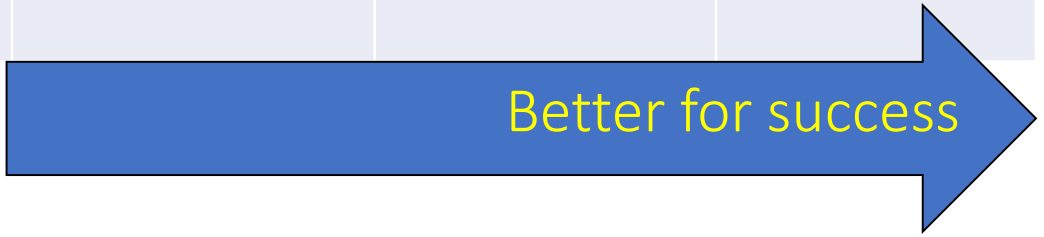
Manpower Study: Types of Work Activity



Conditions for a Better Model

Can you clearly document how many FTE's of In-House and Contract Workers you Employ TODAY?

	None	Some	Strong
Standard Organization Structures			
Strong Workload Data Systems			
Clear Performance Measures/Goals			
Detailed Job Descriptions			
Accurate Work Time Accounting			
Standard Work Processes			
Highly Trained Workforce			

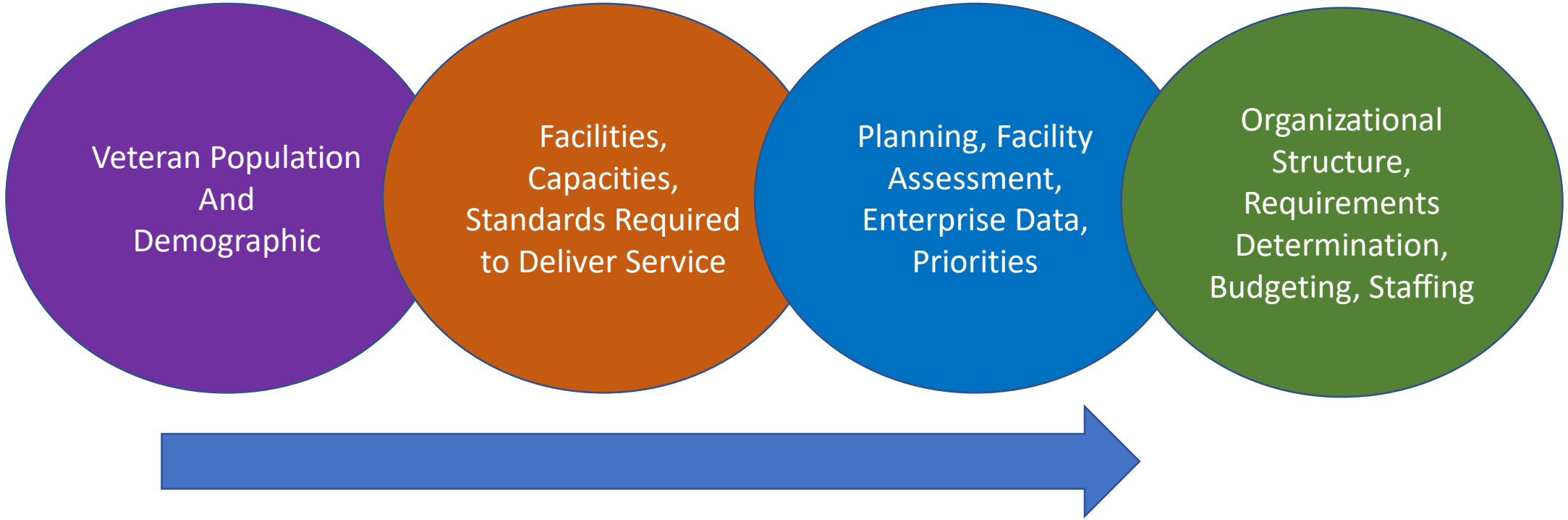


CASE STUDY: AIR FORCE JOURNEY

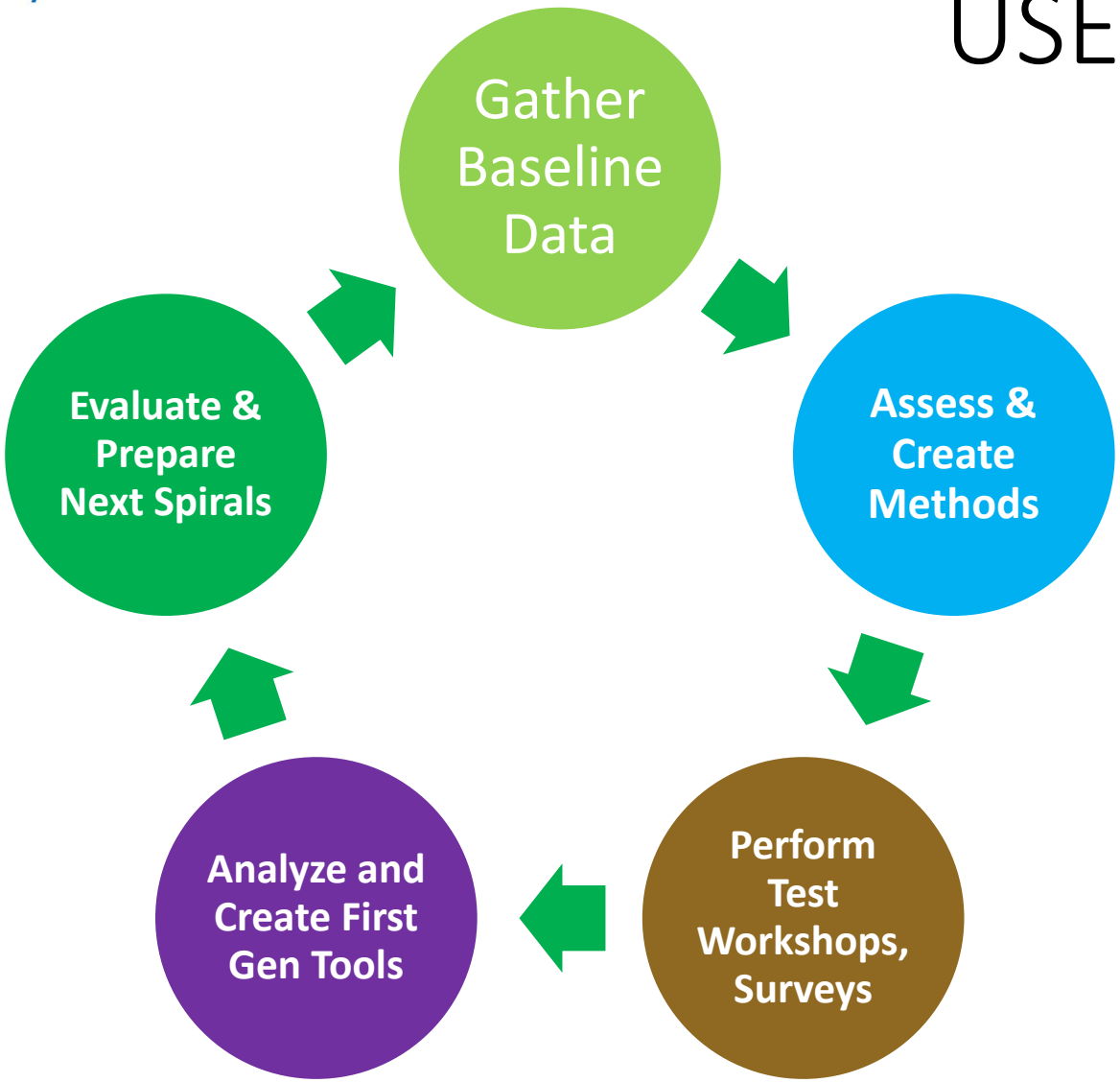
- In 2012, the AF "physical plant" consisted of 166 installations, 10M acres of land, 634M square feet of facilities, 154M square yards of pavement, and 75,800 homes -- aging and suffering series of historical budget challenges
- Legacy Air Force Manpower Standards built upon K-Sq Feet, etc. with Variances
- Civil Engineering Workforce: AF HQ, IMSC - AFCEC, Squadrons, Flights (CEN, CEO, etc.) plus whatever contracted out
- Gathering the Necessary Data: Assessing Facility Status and Defining the Need w/ BUILDER with TABLEAU – Installation Health Assessments very useful
- Can use to express in out-year dollars the project costs to restore and maintain – to properly program Facilities, Sustainment, Restoration and Modernization (FSRM) dollars required – and do required Planning, etc.
- Working with AFMAA, used innovative methods to estimate FTE's required to accomplish the workload associated with the maintenance estimates

RECOMMENDATION: TALK WITH AF CIVIL ENGINEERS AND AFMAA

VHA MODELS FRAMED UPON KEY "Prerequisites"

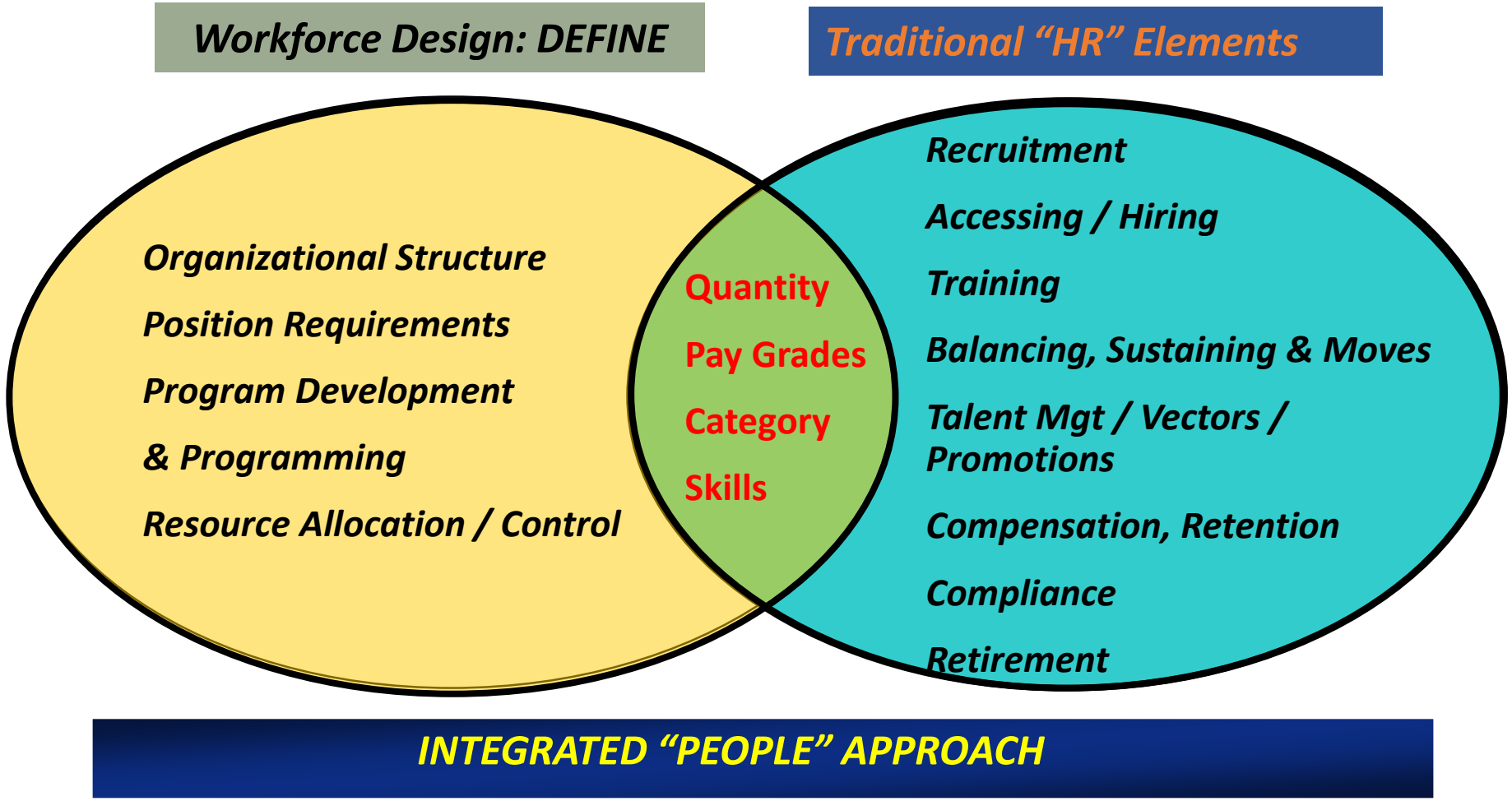


USE SPIRAL APPROACH



- Start with a great baseline
- Benchmark / compare what you've got
- Get something together – then make it better
- Select a portfolio of tools to define requirements by functions / placement within the enterprise

Federal Workforce Staffing Considerations



This is the beginning of the journey…what questions do you have for me today?