Proceedings of the 10th Annual World Conference of the
Society for Industrial and Systems Engineering,
2021 SISE Virtual Conference
September 23-24, 2021

Streamlining Success: Modeling the Efficiency of the Special Forces Qualification Course

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Author's Note: 2LTs Cerda, Rose, Knill, Liu, and Cadet Taber worked on this project as seniors at the United States Military Academy at West Point in the Department of Systems Engineering. LTC Joshua Eaton is a Special Forces Officer and was an Assistant Professor in the Department of Systems Engineering at the United States Military Academy at West Point. We extend our gratitude to the team at the USAJFKSWCS for the inspiration, aid, and commitment throughout this capstone project.

Abstract: The objective of this research project is to perform an analysis of the Special Forces Qualification Course (SFQC) to provide recommendations for improving the efficiency and effectiveness of training. The United States Army John F Kennedy Special Warfare Center and School (USAJFKSWCS) conducts special missions that require an elite group of individuals who are highly trained and proficient in an array of military skills. The initial training to mold soldiers into elite warfighters begins with the SFQC. To analyze the SFQC, the research team leveraged ProModel, a discrete modeling simulator. This tool allowed the team to model the course and its phases, while also manipulating the variables and structure of the SFQC. From the research, the team identified periods within the course that have a backlog of candidates, some key training course-specific causes for these backlogs, and important variables that impact the course's graduation rate. From this, the team was able to create and develop recommendations to mitigate, or eliminate, the inefficiencies for our client, the USAJFKSWCS. The findings will provide the client with results that will influence change to improve the overall efficiency of the SFQC. In conclusion, the project goals moving forward are to conduct further analysis of the training pipeline and provide recommendations that will facilitate further optimization of the SFQC.

1. Introduction

The purpose of this research is to perform an analysis of the Special Forces Qualification Course (SFQC) to provide recommendations for improving the efficiency and effectiveness of training, as well as to provide a tool for future changes. The United States Army Special Forces (SF) – also known as "Green Berets," are elite units tasked with operating in the most arduous environments to perform key missions that conventional units are not equipped to do. The SFQC is responsible for ensuring that SF soldiers are well trained and prepared to carry out these special missions. The SFQC focuses on core tactical competencies including Direct Action, Special Reconnaissance, Counterterrorism, Counterinsurgency, Foreign Internal Defense, Unconventional Warfare, Security Force Assistance, Information Operations, and Peace Operations. It currently consists of six sequential phases of training, shown in Figure 1 below.

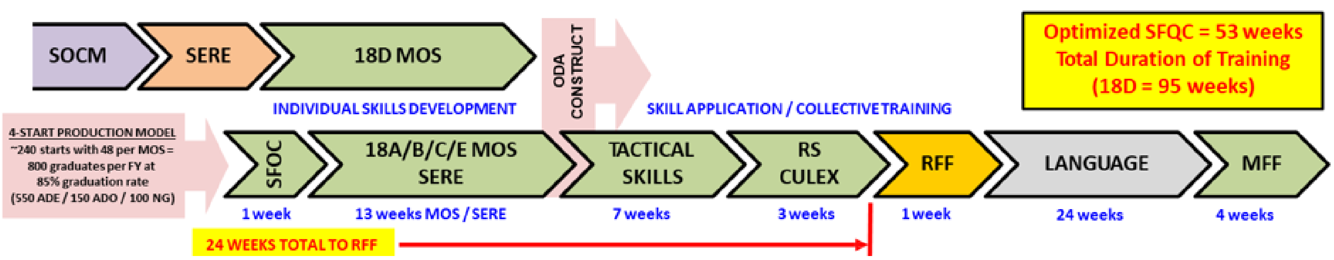


Figure 1. SFQC training phases

Currently, the SFQC is experiencing backlogs within their courses, where soldiers are waiting between training phases until spots are available. The research team seeks to make recommendations on how to optimize the SFQC to facilitate better allocation of resources and training to support the SF mission set. This paper will discuss the methods the team used to conduct this analysis on the SFQC, including the software and assumptions made to develop a working model. From there, the paper will discuss the results from that model. Finally, given the results of the model, the team will provide specific recommendations that will aid in optimizing the SFQC.

2. Methods

The data used to develop and validate this model was given to the team by the USAJFKSWCS. This data consisted of fiscal year 2020 statistics ranging from the number of each MOS enter the SFQC to all the pass, failure, and recycle numbers for each MOS and phase. Combined into a dashboard, the team was able to analyze the data given and determine what data was needed to go into the model. Some of the data going into the model had to be calculated, like the different rates, and everything that was inputted into the model got confirmed by the SWCS team.

The methodology used to model the SFQC is discrete event simulation using ProModel. ProModel provides features that enable aspects of an aging chain model, like discrete flows and pipelines, to be modeled effectively. Often used to model mass production, manufacturing systems, and supply chain models, the software uses several elements or "building blocks" that provide foundation for models (Heflin & Harrell, 1998). For the SFQC pipeline, the team utilized the following elements: Locations, Entities, Processing, and Arrivals. Locations are the fixed places in the system and Entities are the actual items (people in this case) moving through the model. Processing can be understood as the coding or routing that provides the logic, such as wait times at locations. Lastly, Arrivals give the simulation a schedule in which entities enter the model. These aspects and how the team used them to model the course are covered in the remainder of this section.

In this model, entities are individual soldiers or trainees moving through the SFQC. In the Special Forces pipeline, the trainees are divided into five Military Occupational Specialties (MOS), 18A-E. Figure 2 displays an example of how the team portrays the entities in ProModel as "ATrainee," "BTrainee," etc. Dividing trainees into their respective MOSs allows the team to analyze with detail the backlogs in the model that would not be visible if the model grouped all trainees as one entity. As shown later, the team can examine how each MOS is affected throughout the pipeline because of this aspect.

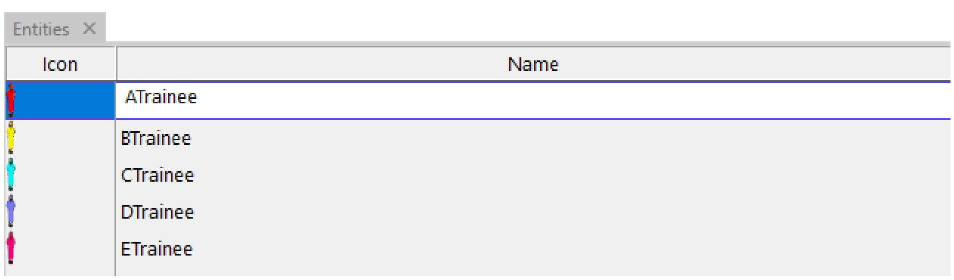


Figure 2. Entities used in the model

Locations are phases within the SFQC, such as MOS training, SERE, or Robin Sage. However, ProModel requires more than just the phases of the school for an accurate model to be created—detailed considerations of the course must be considered and implemented into the model. For instance, in each phase, there needs to be a recycle element for trainees who do not pass the phase and are required to conduct retraining. Additionally, ProModel requires an exit location for each phase to better facilitate the timing between phases and the flow of entities from one phase of the course to another. This exit location acts as a holding place until trainees can enter the phase. The reliefs location removes entities from the model. These trainees are either dropped from or quit the course. Lastly, the DNS, or does not show, location is when trainees do not show up to the next phase and are thus removed from the model. All these locations were created to form the model, shown in Figure 3 below.

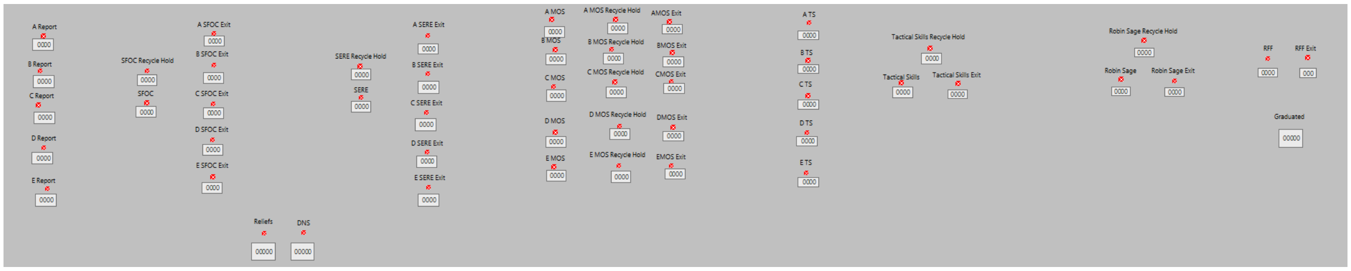


Figure 3. Overview layout of locations in ProModel

The entities and locations previously described provides the foundation for the model, but the flow of the entities through the locations provides the value to the model—this is the processing of the model. ProModel divides processing into two subsections, process and routing. Routing controls how an entity moves to the next destination from its original location listed in the process.

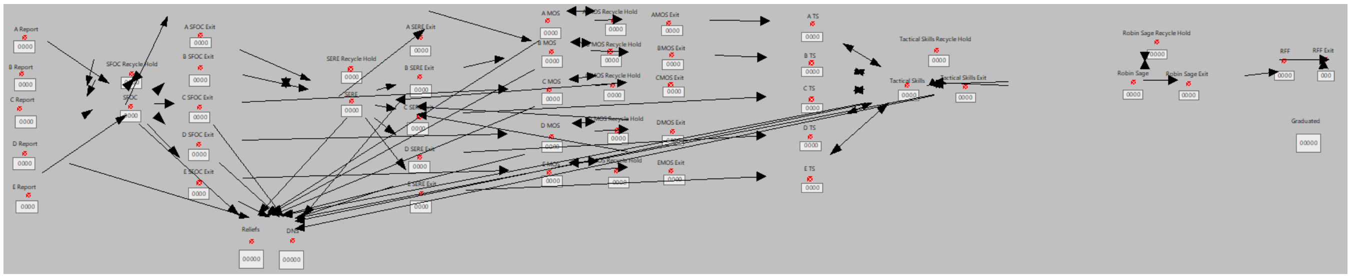
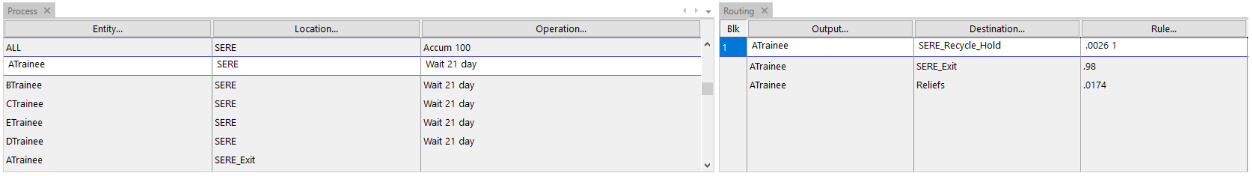


Figure 4. Routes that entities move on in the model

The process aspect is much more complex and, alongside routing, accounts for the main functioning of the model. For each process, there is an entity, a location, and an operation. Every movement of an entity in the model is calculated and outlined under processing. In the operations tab, as shown in Figure 5, more descriptions can be added for what the modeler wants to do with the entity. For this model, the research team mostly used the "wait" function to dictate how long each phase of the pipeline lasts. In Figure 5 below, it is seen that each trainee has a process for the SERE phase that lasts 21 days. On the right side of the figure is the routing aspect of this process. Once the "Wait 21 days" is complete, a percentage of "ATrainee" then moves to the next phases, "SERE_Recycle_Hold," "SERE_Exit," or "Reliefs." The probabilities of passing, failing, or recycling changed in each phase and for each MOS.



Process

Entity...	Location...	Operation...
ALL	SERE	Accum 100
ATrainee	SERE	Wait 21 day
BTrainee	SERE	Wait 21 day
CTrainee	SERE	Wait 21 day
ETrainee	SERE	Wait 21 day
DTrainee	SERE	Wait 21 day
ATrainee	SERE_Exit	

Routing

Blk	Output...	Destination...	Rule...
1	ATrainee	SERE_Recycle_Hold	.0026 1
	ATrainee	SERE_Exit	.98
	ATrainee	Reliefs	.0174

Figure 5. Processing snapshot of SERE phase

3. Results

The results discussed in this section are developed by running the model with initial parameters from the current status of the SFQC. The model allows for the visualization of inefficiencies and backlogs that are occurring, as well as producing data that can be analyzed to further discover ways in which the SFQC can be adjusted. Overall, the results will be used to determine possible recommendations to increase the efficiency of the SFQC.

The first result that needs to be addressed is the inefficiency of the 18B (Special Forces Weapons Sergeant) and the 18C (Special Forces Engineer Sergeant) MOS training phase. Based on the data used and translated to the model, the 18Bs have a recycle rate of nearly 25% and the 18Cs have a recycle rate of almost 30% in their MOS phase, which is significantly higher than the other MOSs. This causes major challenges later in the course due to the reduced number of 18Bs and 18Cs available after their MOS phase. Once they graduate from MOS training and attend SERE, they should combine with the other MOSs at Tactical Skills, with a relatively equal number of each MOS making up a class. However, 18Bs and 18Cs have significantly smaller group numbers entering Tactical Skills, which forces the Tactical Skills class to wait until more 18Bs and 18Cs arrive to fill up the class, resulting in backlogs amongst the other MOSs that are more efficient.

Another option is to move forward with a smaller class, ultimately reducing the number of Special Forces soldiers that graduate. Either way, this issue impacts the required number of MOSs needed for a Robin Sage class. In addition, because the 18Bs and 18Cs have such a high recycle rate, it forces backlogs to occur after SFOC for 18Cs and after SERE for 18Bs because the recycles take priority over the new trainees that are entering the course, highlighted by the red circles in Figure 6.

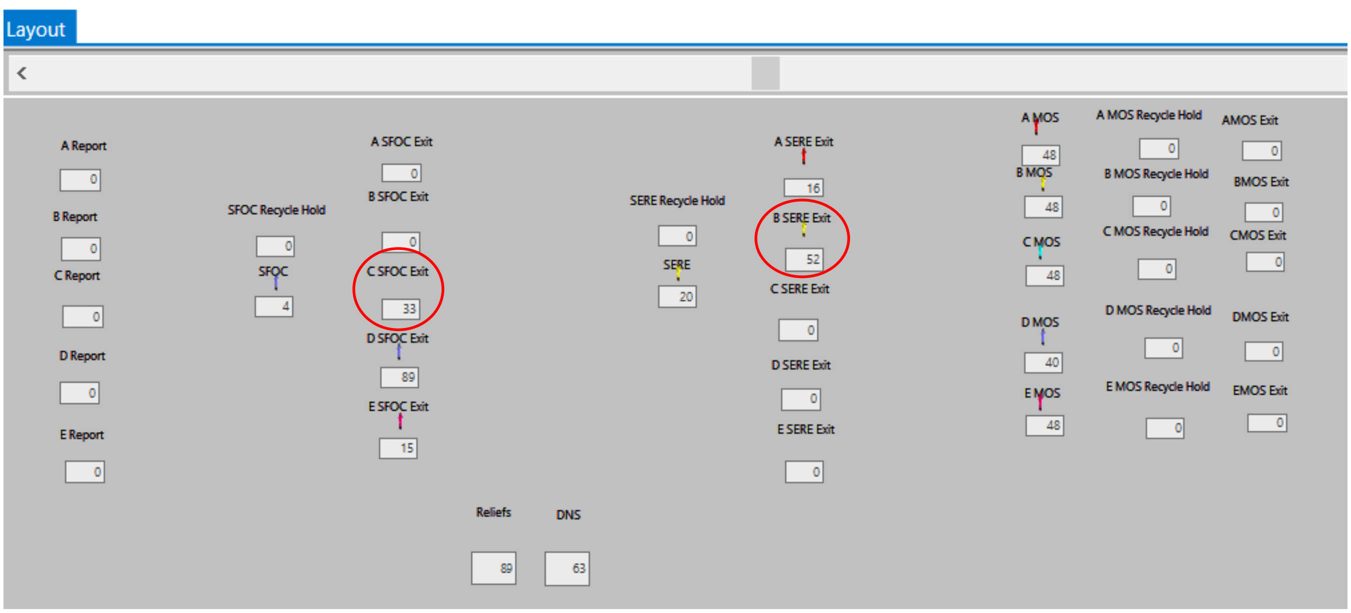


Figure 6. Snapshot of the backlogs occurring from 18B and 18C's MOS training

After running the model for three years, the first to allow the model to populate and calibrate, a time plot can be developed for 18C trainees that finished SFOC and are waiting to start their MOS training. The horizontal axis represents the number of weeks, while the vertical axis represents the number of trainees. Illustrated by the red circles in Figure 7, the team determined that backlogs in the course were occurring when over 25 trainees were waiting in the exit phase for more than 5 weeks. What should be seen when the course is running ideally is large groups of trainees that might wait for a couple weeks and then the number drops close to zero, then repeats itself to create a fairly consistent pattern.

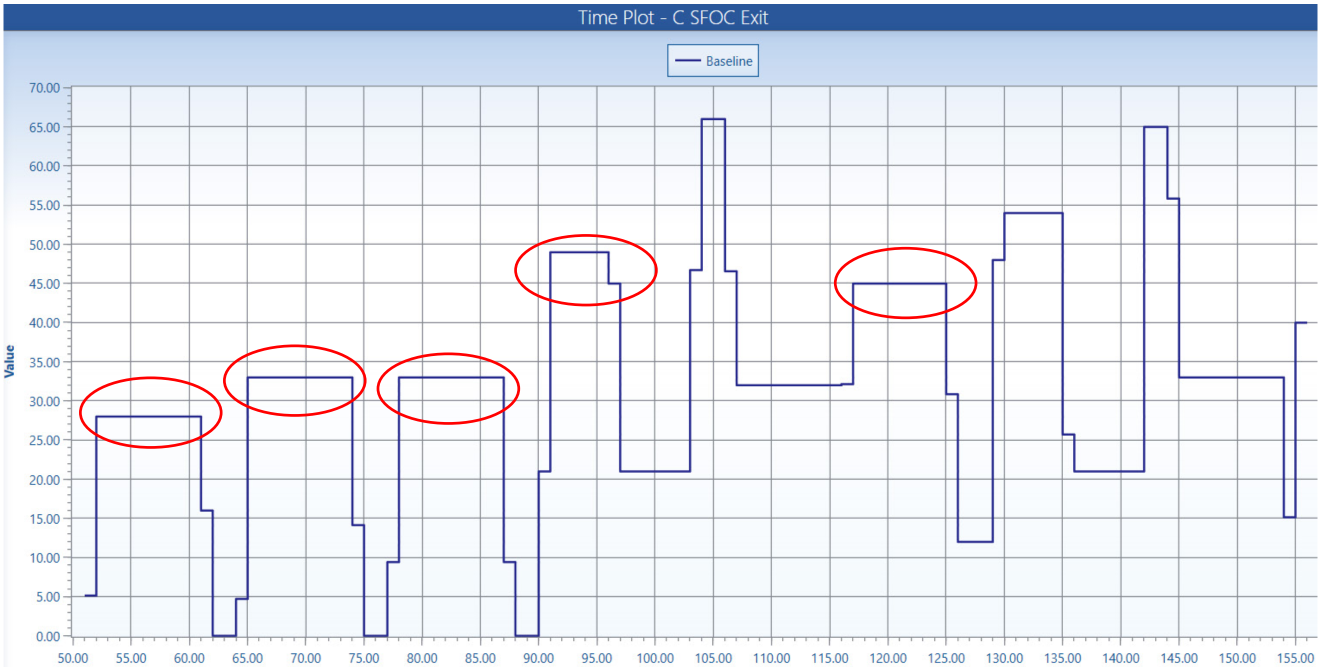


Figure 7. Time plot of the wait time, in weeks, of 18Cs caused by the MOS training

Additionally, the backlog for 18Bs can be seen after SERE training while they wait to begin their MOS training, which is illustrated by the red circles in Figure 8.

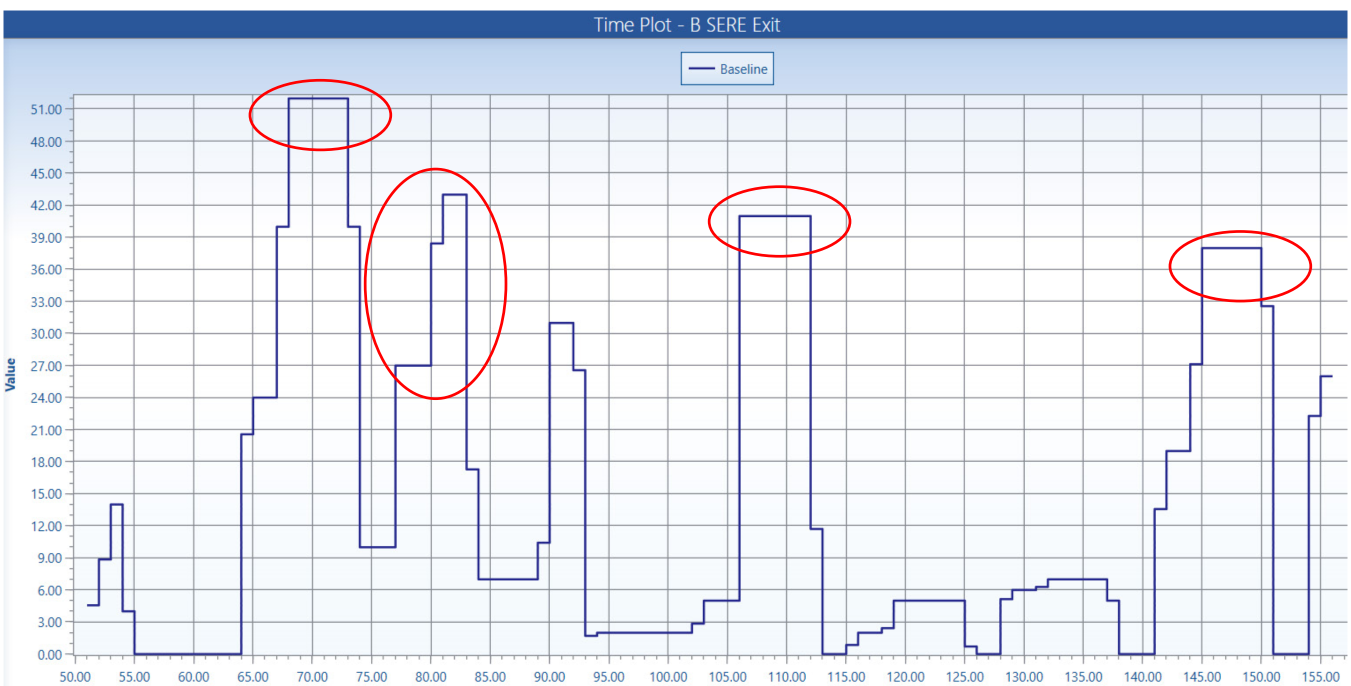


Figure 8. Time plot of the wait time, in weeks, of 18Bs caused by the MOS training

These backlogs mean that only about 75% of an incoming class can move on with training because the recycles take up 25% of the slots. Trainees are forced to wait in these exit phases until there is an opening for them to enter training in the MOS phase.

While the model can clearly show the backlogs that are occurring, it cannot show the command team decisions being made to address the backlogs that affect the current number of trainees. Depending on the situation, command teams have tried to fix the backlog in the past by either rolling back trainees that are waiting or by increasing the capacity of a phase beyond its resource capacity. Rolling back trainees into the next class will add additional wait time by forcing trainees to leave their current class and join the next class coming in. Also, when the command teams increase the capacity of an MOS phase, for example, it creates a strain on the available resources of instructors and equipment. Therefore, the trainees no longer have the same quality of training and may even have certain training opportunities removed to push an over-capacity sized class through the pipeline. When these trainees are removed or added into a class, the model cannot be updated accurately and thus cannot be seen in the data produced by the model.

Another result from this model is directly tied to the inefficiency of the 18B and 18C's pipelines. Currently, an ideal class entering Tactical Skills contains 240 trainees, with 48 from each MOS. The issue that is occurring is that the MOS training phase produces less than the 48 needed and the recycle rate of Tactical Skills does not make up for the number of trainees lost during MOS training. So, this forces the MOSs to wait until they receive more graduates from the MOS training phase, so that they can fill up a class for Tactical Skills. This forces the rest of the trainees to then wait until that Tactical Skills class graduates and then wait until they can get additional trainees to fill up their class, shown in Figure 9 below.

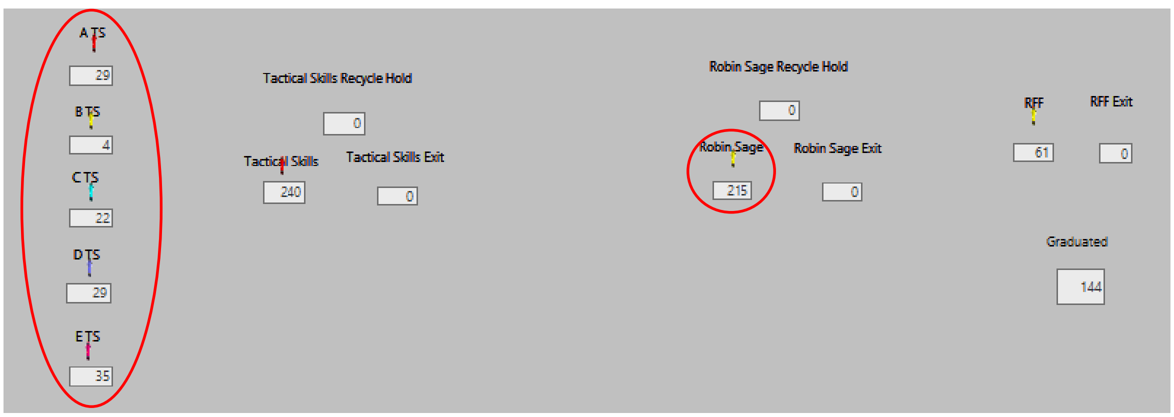


Figure 9. Highlights the delays in Tactical Skills and Robin Sage, caused by previous backlogs

It significantly delays every MOS's training timeline and graduation. If the decision was made to move forward with a smaller Tactical Skills class, there would not be an equal number of each MOS, causing some Operational Detachment Alpha (ODA) teams to be undermanned during this training phase, as well as moving into Robin Sage.

Lastly, after Robin Sage, trainees graduate and have their Regimental First Formation (RFF). However, each class that completes Robin Sage is currently producing around 200 trainees, out of the 240 that start, and the course is designed to graduate around 144 trainees. This leaves roughly 60 trainees that are waiting for the next Robin Sage class to finish so they can have a large enough class to graduate. This is creating unnecessary wait times for these soldiers since the course is trying to graduate too many trainees at once.

Overall, the results from this model highlight several inefficiencies that are resulting from issues occurring from the 18B and 18C MOS training phase and from the demand of trainees in certain phases being much higher than the supply being produced from the previous phases.

4. Discussion

The model, and the results that it produced, allow for the analysis of several recommendations to address current inefficiencies. The first recommendation is to reevaluate the 18B and 18C MOS training phase. For these phases, the high recycle and drop rates give credence that there is an aspect of these courses that is hindering the training efficiency of the phase. It is recommended that these two courses be analyzed to identify which part(s) cause trainees to struggle to complete training in a timely manner. Then it can be addressed by focusing additional training on the identified section to ensure trainees are proficient at the required tasks to meet the standard. The desired goal is to eliminate the backlog occurring prior to the entry of MOS training so that the amount of time spent not training is decreased.

The second recommendation is to reduce the size of Tactical Skills and Robin Sage. Based on the model, trainees must wait a significant amount of time for a full class to be collected before they can start training. This delay is a biproduct of the high recycle rates in the MOS phase and the high-capacity demand for each MOS. While less trainees are entering Tactical Skills than the desired amount, those trainees must wait for the next class to finish MOS training so they can fill the slots. This same issue is occurring in Robin Sage because the class demand is too high. Adjusting the class size for these phases will lead to optimal class sizes for graduation and an overall reduction in wait time.

While this model does a good job of analyzing the current state and the impacts of future changes, it is a relatively straightforward model compared to the overall complexity of the SFQC. In the future, this model can be expanded to include Special Forces Assessment and Selection, Special Operations Combat Medics course, and the Captain's Career Course. This would give a more accurate analysis of the SFQC. Another part of the model that can be updated is the inclusion of the monetary cost of trainees entering the SFQC. This can include the initial cost of each MOS, the cost of each phase, the cost to recycle, and the cost of wait periods between phases. Being able to visualize the impact of cost on the course will allow the leadership to make informed decisions, not only based of the time efficiency of the course, but the cost efficiency as well.

5. References

5th Special Forces Group (Airborne) History. (n.d.). Retrieved November 01, 2020, from https://www.soc.mil/USASFC/ Groups/5th/ 5thSFGHistory.html

Army Birthdays. (n.d.). *Army Birthdays - U.S. Army Center of Military History*, history.army.mil/html/faq/branches.html.

Baldor, L, T. (2019, October 14). *Big changes to grueling Special Forces course draw scrutiny*. Retrieved November 01, 2020, from https://www.armytimes.com/news/your-army/2019/10/15/big-changes-to-grueling-special-forces-course-draw-scrutiny/

Finlayson, K. (2013). A Combat First. Retrieved November 01, 2020, from https://arsof-history.org/articles/ v9n1_sf_in_ korea_page_1.html

Gole, H. G. (2008). *General William E. Depuy: Preparing the Army for Modern War*. Univ. Press of Kentucky, 2008.

Heflin, D., & Harrell, C. (1998). Simulation Modeling and Optimization Using ProModel. *Proceedings of the 1998 Winter Simulation Conference*.

Maurer, K. (4 June 2013). *Gentlemen Bastards: On the Ground in Afghanistan with America's Elite Special Forces*. New York: Berkely Trade. p. 15.

McCarthy, S. MAJ (n.d.). Department of Systems Engineering Instructor. Verbal and written assistance to the author. MAJ McCarthy provided assistance in developing the framework for the latest model that was then built upon and added to. West Point, NY. Jan. 2021.

Murphy, J. (2017). *Special Forces Detachment A: An elite Cold War unit*. Retrieved November 01, 2020, from https://sofrep.com/ news/special-forces-detachment-a-an-elite-cold-war-unit/

Neville, Leigh (2015). *Special Forces in the War on Terror*. Osprey Publishing.

Primary Special Forces Missions. (n.d.). *Goarmy.com*. Retrieved from www.goarmy.com/special-forces/primary-missions.html

Scarborough, R. (2014). *Africa's Fast-Reaction Force Ready to Go from Colorado.* The Washington Times. Retrieved 17 May 2014.

Stewart, R. W. (2005). Chapter 14 The Global War on Terrorism. In *American military history* (Vol. 2, pp. 459-468). Washington, D.C.: Center of Military History, United States Army.

Sof, E. (2020). Army Special Forces Operational Detachment Alpha (ODA). *Spec Ops Magazine*, 23 Oct. 2020, special-ops.org/army-special-forces-operational-detachment-alpha-oda/.

Heritage Foundation (2015). *The Importance of Special Operations Forces Today and Going Forward. The Heritage Foundation.* Retrieved from www.heritage.org/military-strength-topical-essays/2015-essays/the-importance-special-operations-forces-today-and.

U.S. Army Special Forces Regiment. (n.d.). Retrieved November 01, 2020, from https://www.soc.mil/SWCS/Regimental Honors/SpecialForces.htm