Risk Based Deployment Model for the Calgary Fire Department

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

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Abstract

The problem was that the Calgary Fire Department (CFD) had not determined whether to continue with and adopt the risk based deployment model being piloted, which added a level of uncertainty amongst the operational staff. The purpose of the applied research project (ARP) was to determine if the risk based deployment model being piloted in the CFD should continue and be adopted. The research sought to use an evaluative research method to answer five questions: how does the pilot model compare to the standard model in relation to the Fire/Rescue first-due unit; Life-Threatening Emergency Medical first due-unit; and the Fire Effective Response Force (ERF) response time performance targets? Additional questions related to the adoption of the pilot were: what modifications to the pilot could be made to improve response time performance and what perceived challenges and strengths exist to adopting the pilot model? Procedures were followed that utilized data analysis from the FireRMS data management system to identify first-due fire/rescue and life threatening emergency medical incidents response. The data was then used to calculate the 90th percentile travel time performance and the percent of response performance target met for the pilot and traditional models used in 2013 and 2014. This was repeated for the ERF performance response calculations. A survey was drafted and distributed to selected CFD staff to get feedback needed to answer questions four and five. The results from the research conducted demonstrated that for a majority of individual first-due districts and for the overall system performance, an improvement was made using the dynamic deployment pilot model. The main recommendation made from the research was that CFD should adopt the pilot model to improve performance and service delivery. Additional recommendations were made regarding changes to the model for improvement in adoption and for further research proposed.

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Finding the right balance between an appropriate level of service delivery and cost to deliver the service as a community experiences expanding growth is a concept that the fire service is increasingly struggling with (Center for Public Safety Excellence, 2008). This struggle means that fire service leaders must continually evaluate and adjust their deployment models to meet response time service levels. In 2008, the Calgary Fire Department (CFD) developed a set of benchmarks and service levels that were specifically designed to meet the unique circumstance that exist within the City of Calgary (Calgary Fire Department, 2008). Unfortunately, those unique circumstances have continued to change.

As Calgary continues to experience huge levels of population and developmental growth, this has also resulted in increases in service demands, call volumes and changes to risk levels across the city. These changes have produced challenges for CFD in meeting its Council adopted performance targets which prompted CFD to launch a performance improvement program (Calgary Fire Department, 2014). As part of the performance improvement program, in December 2013 CFD implemented a dynamic deployment model that was based more upon risk designed to improve response performance and station reliability. "The model applies a systematic approach to redeploying resources, ensuring that areas identified as high risk and with high probability of incidents occurring have the resources available to perform the critical tasks associated with the incident and its potential level of risk" (Calgary Fire Department, 2014, p. 27). Based on the implementation of the risk based deployment model, this research aimed to evaluate the new model in order to aid the Fire Executive Team (FET) in decision making for maximum performance delivery.

The problem is the Calgary Fire Department has not determined whether to continue with and adopt the risk based deployment model currently being piloted. This has added a level of uncertainty amongst the operational staff as to which model is best. The purpose of the applied research project (ARP) is to determine if the current risk based deployment model being piloted in the CFD should continue and be adopted. This applied research used an evaluative research method to answer the following five questions: (a) how does the pilot model compare to the standard model in relation to the fire/rescue first due unit response time performance target; (b) how does the pilot model compare to the standard model in relation to the life-threatening emergency medical first due unit response time performance target; (c) how does the pilot model compare to the standard model in relation to the fire effective response force (ERF) response time performance target; (d) what modifications to the pilot could be made to improve response time performance if target areas were not achieved; and, (e) what perceived challenges and strengths exist to adopting the pilot model?

Background and Significance

Calgary is the fifth largest metropolitan area in Canada and the largest city in the Province of Alberta positioned about 80 kilometres east of the Rocky Mountains. Calgary comprises 848 square kilometres of land with a population base (April 2013) of 1,149,552, which constitutes a 10% increase in population from 2008 (Calgary Fire Department, 2014). Combined with the increase in population, Calgary has also experienced tremendous development growth with a 53.6% increase in building permits over the last five years yielding over 468,000 dwellings.

As the city continues to grow, so does the demand for services that CFD experiences. CFD responded to 55,804 incidents in 2013; an increase of 11.9% from 2008, involving 109,596 apparatus responses. Although CFD has seen a decrease in the volume of fire incidents, “it has seen a growing need for its service in other areas vital to community and environment safety, such as emergency medical, severe weather and hazardous conditions incidents” (Calgary Fire Department, 2014, p. 5). CFD provides front line service from 39 stations positioned strategically across the city, staffed by 1289 firefighters.

In 2007, CFD undertook a review of its service delivery performance in conjunction with a performance benchmarking project with the goal of establishing a model of service delivery that could meet the unique demands placed on CFD. These demands included financial, growth, political, risk, citizen expectations, industry and internal needs and capabilities. This review proposed three different service level options each with a different level of financial support. It was brought to Calgary City Council for a decision on the model that would be considered appropriate, affordable and acceptable for the citizens of Calgary. Council adopted and set the performance model that was the middle of the three options. This then became the base line of service delivery that CFD would implement; aligned to the long term target associated with service that CFD would strive to achieve within the prescribed time frame over a phased approach (Calgary Fire Department, 2008). The phased in approach of incremental improvement was chosen to be a more financially acceptable model of improvement opposed to a direct shift in service which would require a significant financial influx to CFD to address the performance gap.

The project yielded 18 performance measures, three of which related directly to response performance and the service levels expected by citizens. These three performance measures are: (a) first-in unit emergency response within seven minutes at fire rescue incidents 90% of the time; (b) first-in unit emergency response within 6 minutes and 30 seconds at life threatening emergency medical incidents 90% of the time; and, (c) full first alarm assignment at a fire suppression incident within 11 minutes 90% of the time (Calgary Fire Department, 2008). These targets were a change from the existing response performance and established a new service level that would be built into planning, evaluation and operational objectives within the business and budget plan for CFD and the City of Calgary. These levels are based on standard components of total response time targets made up of call time (time from Public Safety Answering Point {PSAP} receiving the call until initial response information sent to crews), turnout time (time from crews receiving initial alarm until enroute), and travel time (time from crews enroute to incident until arriving at dispatched location) (Center for Public Safety Excellence, 2008).

CFD continuously monitors and reports on its performance in relation to the Council approved targets monthly, quarterly and annually. Monthly, the operations division reports on performance to the FET as part of management oversight and trending accountability. Quarterly, CFD reports to the city Chief Financial Officer as part of business plan performance measures accountability and annually CFD provides an annual report to City Council and an Annual Compliance Report to the Center for Public Safety Excellence as part of its accreditation program through the Commission on Fire Accreditation International (CFAI). Since adopting the new service levels in 2008, CFD has made improvements to its response time performance but has not achieved the annual targets set out in mandated business plans. This is attributed to the struggle to manage growth within the city. New stations and resources have been added but an increase to volume demands, response reliability issues and increased travel times continues to occur. As part of its continuous improvement focus, in 2011 CFD started a response focused performance improvement program (Calgary Fire Department, Strategic Services, 2013).

The performance improvement program involved a number of projects which were conducted, researched, evaluated and initiated by internal staff of CFD and by external consultants. Constant review of travel time results by CFD staff showed that changes or enhancements were required to improve the three key measures of first-in unit and effective response force performance (Calgary Fire Department, 2014). The dynamic deployment model currently being piloted in CFD was one strategy that resulted from this performance improvement program (Calgary Fire Department, Strategic Services, 2013).

The dynamic deployment model is based upon a risk based deployment model rather than an incident based model. This strategy was designed to target travel time issues where problems existed due to large fire district size, high call volumes, higher risk areas, areas where the probability of a second call coming in when the primary unit was already assigned was high and areas where there was traffic or road network issues. Research was done by the CFD Strategic Services division to identify those fire districts where travel time performance was below target levels and also identify the root cause of those performance issues. Some of this work leveraged the work done by an external consulting firm retained by CFD, DarkHorse Consulting, and built off of the station analysis work they conducted (Calgary Fire Department, Strategic Services, 2013). The report produced by CFD's internal work identified that there were ten critical stations that due to probability of calls coming in while a unit is already on a call produced reliability risks where a unit from out of district had to respond to the second call causing over goal responses. The work also built a matrix of all stations and placed them in order of least impact on performance to greatest impact if that station was empty and unable to respond. The dynamic deployment report produced recommendations that were presented to FET for approval and as a result, the pilot was implemented in December 2013 and is currently still in place.

The recommendations that were adopted and form the pilot are: a) the ten critical stations should always have an engine in them due to high probability of call volumes; b) five of these critical stations are so busy that there should be two engines based out of them; c) if any critical station engines are out on calls for longer than approximately 20 minutes, another engine should be re-deployed to that station from a lower risk station; d) CFD should utilize secondary units such as aerials and rescues to act as primary units if engines are out on calls; and, e) in an attempt to not leave any stations empty and to provide an in district response wherever possible, secondary units should be re-deployed to stations where an engine is unavailable (Calgary Fire Department, Strategic Services, 2013). The goal of the pilot is to improve travel time response performance in accordance with the target performance measures and allow CFD to meet its service level delivery model.

This issue is not only affecting Calgary but to a degree has the ability to affect other large urban fire service providers in a similar fashion due to the increasing demands of growth coupled with the growing financial constraints of municipalities. If CFD cannot adjust its service delivery model to improve performance it risks the chance of losing its accreditation through CFAI for gross deviation of its response and reliability performance, losing the trust of the citizens it serves, causing significant financial demands to the City to improve performance gaps and most importantly, increasing the risk to the safety of citizens and firefighters by not being able to meet critical tasking functions.

The intent of this applied research project aligns with the Executive Fire Officer Program (EFOP) Executive Development Course goal of “lead effectively and efficiently within a dynamic and complex organization by enhancing the development of teams and the application of research” (United States Fire Administration, 2012, p. ix). Specifically related to the United

States Fire Administration (USFA) strategic and operational goals #1 and #3, the researcher intended to reduce the risk at the local and organizational level and improve the fire services capability for response by evaluating models that provide the best response performance success for the CFD (United States Fire Administration, 2013).

Finally, this topic meets the identified selection criteria as outlined in the *Executive Fire Officer Program – Applied Research Guidelines* (United States Fire Administration, 2013, p. II-2). This research is significant to CFD as it is key to ensuring a sustainable fire service and meeting the service expectations of City Council and citizens. This is also a strategic goal for the fire service as conditions and circumstances change, departments need to be flexible and adapt with their changing environments.

Literature Review

An extensive literature review was conducted by the researcher in relation to risk based deployment, deployment models and evaluation of response performance. While in attendance at the EFOP Executive Development course at the National Fire Academy in July 2014, the author attended the Learning Resource Center (LRC) and with the assistance of staff conducted searches that revealed sources in journals, Executive Fire Officer Program research papers and books. One issue that was identified in the literature review was that there was not a lot of related material on deployment models that was within the last five years. The review was done looking at a variety of performance evaluation and deployment of resources for emergency services not just the fire service and several pieces of literature identified were related to dynamic deployment of Emergency Medical Services (EMS). Due to the fact that three research questions identified for the problem related to travel response times, the literature review looked at the three questions at the same time.

How does the pilot model compare to the standard model in relation to the Fire/Rescue first due unit response time performance target?

How does the pilot model compare to the standard model in relation to the Life-Threatening Emergency Medical first due unit response time performance target?

How does the pilot model compare to the standard model in relation to the Fire Effective Response Force response time performance target?

The National Fire Protection Association (NFPA), sets out guidance documents that are viewed as the standard referenced in the delivery of fire services within the industry and legal systems even though NFPA itself identifies that the authority having jurisdiction (AHJ) determines their own standards and performance and that NFPA neither approves nor certifies said performance (National Fire Protection Association, 2009). As indicated by NFPA (2009, pp. 9-10) in the 1710 document, a career fire department should target for a) first arriving engine company at a fire suppression incident within 240-second (4 minute) travel time at the 90^{th} percentile, b) arrival of a first responder with AED at an EMS incident within 240-second (4 minute) travel time at the 90^{th} percentile, and c) arrival of a first full alarm assignment at a fire suppression incident within 480-second (8 minute) travel time at the 90^{th} percentile. This standard goes on to state that the fire department shall at least annually, evaluate the level of service provided to the community including its travel time performance. These evaluations need to be based upon actual emergency incident data in the areas of service, deployment and the time performance goals set for each first-due district across the department within the whole municipality. One critical aspect of the evaluation; that should be provided from the department to the AHJ, is the identification of the first-due districts that are not achieving their performance goals and the reasons for it.

This standard is intended to guide a fire department to meet the principles of operating an efficient, effective and safe service delivery for citizens and firefighters. The underlying principle for any fire service organization is to reduce the risk to their municipality through a number of means which includes preventing and limiting the extension and severity of fires, the rescue and removal of any victims, and the delivery of any other approved operations such as EMS. A key concept of this standard is that the AHJ is responsible and accountable to set the system, staffing and deployment used to attain the service level and response time performance. The AHJ should set their response goals specific to their own area of responsibility based upon a risk assessment including factors that affect response personnel, building and fire codes, adopted travel times, facility and occupancy hazards and risks. Currently, NFPA 1710 is used as a base document by many fire service agencies however it is widely contested that it is very costly from a financial perspective for departments to meet the standard (MacCharles, 2008).

Fire service accreditation by the Commission on Fire Accreditation International (CFAI) through the Center for Public Safety Excellence, Inc (CPSE) has gained increased acceptance in the fire industry due to its focus on establishment of service level and program performance measures and continuous improvement. An important difference between NFPA and CFAI that appeals to the fire service is the notion adopted by CFAI that due to specific and varying differences between jurisdictions where fire services are delivered, it is evident that “no ‘one – size-fits-all’ solution” (Center for Public Safety Excellence, 2008, p. 7) exists. One of the documents that is required as part of the accreditation process is a Standards of Cover report. According to CFAI (Center for Public Safety Excellence, 2008, p. 11) there are four elements critical for the development of standards of cover: a) a community based risk assessment specific to the agency completing the process; b) identification of the service levels provided; c) a review of the agency's current response specific to time and performance of both staff and equipment; and, d) a plan outlying how all resources will be used and deployed in order to capitalize response effectiveness across the jurisdiction.

Standards of cover are very important to the credibility of a fire service. These standards form a documented deployment strategy for the organization that balances the risks identified within its area of responsibility with the service expectations of the citizens and the municipality's financial capabilities (Center for Public Safety Excellence, 2008). The risk levels in one community may be entirely different than the risks and therefore the needs in another; this is why a standard base level is used to build on for each AHJ added to by the results of the community risk assessment. The identification of risks across the community is essential to the placement and number of resources and to the measures that the service can offer. As a result of the risk assessment conducted, service level performance goals will be set that will allow a review of the complete system performance.

The CFAI process also includes a performance measurement component in the standards of cover (Center for Public Safety Excellence, 2008). The evaluation of system performance can be measured in different ways depending on the capability and sophistication of the agency involved but are comprised of four areas of focus: a) distribution – which represents the performance of first due engines within each first-due district; b) concentration – which represents the performance of an effective response force of full first alarm assignments; c) reliability – which represents the performance within first-due districts if primary resources are already committed to an incident; and, d) comparability – the comparison of the agency to other agencies of similar demographic and response models (Center for Public Safety Excellence, 2008, pp. 118-120). CFAI also uses a self-assessment manual as part of the accreditation process.

In this manual, a matrix is provided that sets out benchmark (long-term goals) and baseline (current performance) targets used by agencies for analysis (Center for Public Safety Excellence, 2009). The matrix uses the existing NFPA standards of 1710 and 1720 as they relate to travel time only and identifies that if an agency varies between the ranges in the matrix, they need to be able to explain the reasons behind the gap.

As an accredited fire department, CFD has established a Standards of Cover and follows the criteria set out by CFAI. As part of the evaluation process looking at system performance, CFD identified that it was not meeting the adopted performance targets and implemented a performance improvement programme (Calgary Fire Department, 2014). A dynamic deployment model was instituted which focused on demand for services, risk levels, and station specific operational needs. As part of the overall risk assessment for Calgary, these factors allow CFD to deploy resources and provide response coverage for a changing environment where they require the greatest type and concentration (Calgary Fire Department, 2014, p. 67).

One of the earliest and still most valid publications related to fire service performance evaluation and dynamic deployment was conducted in 1975 by Edward Ignall and his co-authors. In the article (Ignall, et al., 1975), the authors looked at the deployment problem in the New York Fire Department (FDNY) as one problem made up of three components consisting of an allocation problem, dispatch problem and relocation problem. In relation to this research paper, the two problems of allocation and relocation are most relevant. Allocation refers to how many companies are needed in total and how should they be distributed to the various first-due districts while relocation refers to how that allocation should change in times of busyness or when large events are ongoing (Ignall, et al., 1975, p. 50). The article looked at traditional solutions in the fire service whereby adding of additional companies was utilized in attempts to combat incident rate increases and the subsequent workload increases of some companies. Historical data from FDNY showed that instead of reducing the individual workload of a company by adding a second one the overall number of responses during busy times increased. In addition, the traditional relocation policy failed to meet demands under busy times as the planned relocation of a company to backfill another was not available as both units were already busy on calls due to proximity to each other in busy first-due districts (Ignall, et al., 1975, p. 52). Ignall et al employed a semi-markov decision model in their research which was used to determine appropriate deployment based upon not only current incident needs but also future expected incidents. In essence this model is based on call volumes and the probability of other incidents coming in.

The FDNY research also used a square root model to combine both distance and time models which resulted in the ability to predict response times in each first-due district across the entire city. From this the department was able to identify seven companies that could be moved to areas where the need was greater with minimal impact on the system (Ignall, et al., 1975, p. 58). A dynamic relocation model incorporating an algorithm was developed to replace the traditional one. This new model was based on two issues, that of providing the same service across all areas of the city which competes with the second issue of response times. Ignall et al proposed that a better model would provide at least minimal coverage to all areas and then address the relocation assignment through the balance of distance moved to relocate and the risk of the areas being backfilled or left vacant.

In conjunction with the work by Ignall and his colleagues another research paper was also looking at the FDNY deployment and was used to form some of the conclusions of Ignall. This research looked at a dynamic algorithm to identify which relocations should be made to which empty stations and which companies should be moved (Kolesar & Walker, 1974). Again the idea was to balance the equity of providing equal service to all areas against that of meeting response time performance. The literature described two primary goals, the first being that of providing equal service across the whole City. The research identified that in reality this is not achievable as the minimum response necessary is not constant and changes in different areas based upon the risks and hazards specific to each first-due district. FDNY then allocates the resources required in each area based upon political, operational and historical data resulting in a concentration of resources in some areas and spreading out resources in others (Kolesar & Walker, 1974, p. 251).

The second goal of the literature was to identify the cost of relocating or moving resources in relation to the minimum resource response identified. Kolesar and Walker (1974) recorded three criteria that were used as cost identifiers in the evaluation to move resources: a) do not move a company too far a distance from its home, b) do not move a company that is already a busy company and c) do not move a company that is responsible to protect too large a first-due district (Kolesar & Walker, 1974, p. 252). The paper also identified that the cost of relocation was not valid unless the move was required for a period of more than 30 minutes and that a successive move (moving a unit closer to a location and the subsequent unit into the required location) was not as effective as just leapfrogging (moving a unit passed the next location and directly into the required location) units where required.

In some ways EMS systems have been utilizing and open to dynamic or unit repositioning more than the fire service. A paper from the University of Alberta, School of Business discussed the use of a markov model for repositioning of ambulances (Alanis, Ingolfsson, & Kolfal, 2013). The paper looked at the use of compliance tables used by dispatchers to decide whether to follow a static model where units only respond from their home locations, a dynamic model where units are repositioned based upon changes to the system needs or a combination of both. Alanis et al identified that “A well designed repositioning policy can improve performance through better dynamic matching of ambulance supply and call demand" (Alanis, Ingolfsson, & Kolfal, 2013, p. 216). The markov model used was based on the assumption that when the number of ambulances used and out of service increases or decreases, the complete system is out of compliance and then the static tables are not valid. A number of new compliance tables were generated and inputted into the markov model to try and balance the top three scenarios of base, low and high volume scenarios which revolved around the service time and response time factors. The conclusions from Alanis et al (2013, p. 230) was that a markov model could be used by dispatchers or planners to estimate predictive outcomes of response times through a compliance table. It was interesting that the compliance table chosen for actual use was the top or very close to top table used in the simulations.

As seen in some of the reviews listed above, redeployment analysis has been looked at from both a manual and computerized algorithm model. One review that focussed on a computerized approximate dynamic programming (ADP) approach for ambulance redeployment was done through Cornell University (Maxwell, Restrepo, Henderson, & Topaloglu, 2010). This research was prompted by the factors that EMS managers see as affecting response performance; increasing costs of equipment, increasing call volumes, and worsening traffic conditions such as congestion, distances and construction. Maxwell et al looked at three different classes of redeployment models: a) a real-time model that is used whenever a redeployment decision needed to be made based on the work of Kolesar and Walker (1974), b) a pre-planned model which involved a table to be used by dispatchers that identified based on the number of ambulances available where they should be located and c) a model based on the randomness of need and locations based on a dynamic programming formula (Maxwell, Restrepo, Henderson, & Topaloglu, 2010, p. 267). The research showed that the ADP model proposed provided advantages over the other two classes of models. Some of the advantages identified were that the ADP model really captured the randomness of an ambulance system where the need for service can change momentarily and historically, it allowed for a quick computation where a table could have multiple decision options based on travel and road network factors, and finally, the ADP model can be fully automated where a table still required some subjective interpretation and input from the people using the tables. There were also some negative or non-desired effects of the ADP model. Once the system generates a redeployment decision, it is a snapshot at a specific period of time and if another unit becomes available that is not factored into the previous decision. This could in fact have units passing themselves on the way to their redeployment locations (Maxwell, Restrepo, Henderson, & Topaloglu, 2010, p. 269). Another area looked at in the research from Maxwell et al was the value of making redeployments. They looked at making a unit redeploy only when it showed a benefit over not making the move by a significant margin. Overall, the research demonstrated that an ADP model could allow for an increased quality of redeployment policy that produces better performance and better cost value of moves.

What modifications to the pilot could be made to improve response time performance if target areas were not achieved?

Church, Sorenson and Corrigan (2001) looked at the notion of manpower deployment in emergency services. They identified that the deployment problem had essentially two parts to it a personnel and a location/allocation part. The location /allocation part revolves around the need to have the right resources and equipment to meet the demand for services over a geographical space at a specific time. Traditionally, deployment in the fire service is done through long term planning which identifies the placement of resources in fixed stations for spatial coverage (Church, Sorenson, & Corrigan, 2001, p. 221). Very infrequently are changes in resource allocation made after that point unless new stations are added, moved or closed. Church et al discuss the value of technology in long term planning such as computer aided dispatch (CAD) and global positioning systems (GPS) to improve deployment planning and implementation. Further, they state that to be able to achieve any significant gains in service or system efficiency, a department needs to be focused on optimal or near optimal solutions. Some ideas that are mentioned around the optimal performance are solutions that are longer term focussed, solutions that are flexible or dynamic enough to be successful in multiple situations and solutions that can be incorporated with CAD, GIS and business intelligence technology (Church, Sorenson, & Corrigan, 2001). In summary the review identifies that to solve the deployment problem; managers need to be flexible over time in order for deployment to be amended as needed when the system needs change (Church, Sorenson, & Corrigan, 2001, p. 233). This is a common issue facing all emergency services and if not addressed leads to inefficient and poor performance, which also leads to less cost effectiveness of operations and potentially damage, injury and death.

The United Kingdom has been doing research on changing their deployment models over the last decade. DMS Peace wrote a paper for the Home Office in 2001 related to a new standard of deployment. In the UK, a pre-planned response to a geographical risk is known as fire service emergency cover and is defined as “the intervention resource provided continuously by a fire brigade to respond to an incident which is reasonably likely to occur, in order to keep the risk from hazards within tolerable bounds” (Peace, 2001, p. 280). Peace went on to state that cover could only be provided to emergencies that had been planned and that since risk changes, cover should change as well. It was noted that although risks were documented in some areas there was not enough quantitative data present for all areas. To overcome this, fire brigades were given risk toolkits that they could use to assess the risk that were present within their own area of response. These localized risk assessments were then fed into the Geographical Information System (GIS) where they could be better used for cover planning. Through analysis of the statistical data collected by the risk assessments, the fire service was able to identify a relationship between the risks of death for various response times (Peace, 2001, p. 283).

Peace then describes how an emergency cover planner can conduct a manual allocation of resources to the current stations (which are deployed with resources to eliminate the intolerable risk that exists) in order to drive down the level of tolerable risk by deploying additional vehicles if it is cost effective and of value. This model is described by Peace as a balancing of workload between busy and not so busy vehicles whereby, vehicles from farther away stations are re-deployed to cover off the time that the busy vehicles are utilized (Peace, 2001, p. 285). This balancing occurs until the iterations of reallocation drops below a pre-determined threshold which is what Peace identifies as the optimal level of coverage.

Vancouver Fire and Rescue Service had a deployment study conducted by TriData Corporation in 1996. The report identified a number of things to consider for changes to the deployment model. First it was noted that the engine companies were the primary units used for both suppression and medical incidents and that while on a medical incident the companies are unavailable for suppression response even though the full crew and apparatus are rarely required. Also noted was that it was beneficial to providing medical response as quickly as possible for the success of the chain of survival for people experiencing cardiac arrest and as such Vancouver equipped all their front line apparatus with automatic external defibrillators (AED) and trained all members to provide first responder medical care (TriData, 1996). TriData found that the 14 ladder companies that Vancouver had were underutilized and that the number of ladder companies could be reduced and the staff placed onto other units that would be a more efficient use of resources. The study identified that minimal coverage should be able to be maintained with the allotted number of units on secondary response (training or other duties) while the other companies are being used at a normal rate of incidents. This identified minimal coverage should also be maintained with one two-alarm fire or two one-alarm incidents without affecting city coverage. To achieve this, Vancouver used ladder companies to cover in several stations when the minimal number of engine companies to provide city coverage was not maintained. This led to a recommendation that engine and ladder companies should be combined into quint companies to allow for staffing and equipment capabilities available for all responses.

The International City/County Management Association (ICMA), publishes reports and articles related to pressing issues in emergency services. In a 2010 InFocus article, Fitch, Ragone and Griffiths discuss the costs of fire and EMS services in the current economy and alternatives being made by departments. Fitch et al identify that several fire departments have successfully implemented various strategies to meet the service demands they are faced with. In Tualatin Valley, Oregon they instituted peak time engine and rescue companies to match service levels to demands (Fitch, Ragone, & Griffiths, 2010) and San Jose, California is using a *dynamic deployment* strategy that incorporates resource management software and data information and analysis along with the personnel from the communications center to manage service demands. Finally, Fitch et al emphasize the need for departments to use factual data to drive decisions. They suggest that there are two fundamental components when evaluating resources and service demands: “a) provide geographical coverage so that appropriate resources may respond in an evidence-based time frame for medical and fire calls and b) supply those resources in adequate numbers to meet fluctuations in call demand" (Fitch, Ragone, & Griffiths, 2010, p. 15).

What perceived challenges and strengths exist to adopting the pilot model?

Anytime that a change is required in a workforce there exists the potential for resistance to the change. Heifetz and Linsky in their book *Leadership ON THE Line*, discuss the dangers of being a leader in organizations and detail that it becomes more difficult and costly in adaptive challenges than in technical ones. Adaptive challenges are ones where there needs to be a new learning for the people involved and they need to give something up or suffer a loss, possibly to their values, beliefs, or habits (Heifetz & Linsky, 2002). Heifetz and Linsky further explain that adaptive change requires people to feel uncertainty and even disloyalty to their traditions, culture and possibly the people that have come before them (Heifetz & Linsky, 2002, p. 30).

In the July 2012 edition of *JEMS*, Washko describes how EMS service delivery needs to change to better meet the outputs required by patients due to changes in healthcare. Washko focuses on the idea that response time and clinical effectiveness are linked and best delivered for most medical emergencies by EMS systems. Dynamic deployment models are noted as effective delivery methods due to their use of appropriate resources to meet the patients needs and fast response times due to the ability to move units where needed most (Washko, 2012, p. 35). However, Washko also identifies that although effective delivery models, dynamic deployment models cause a decrease in morale with staff due to the interruption to regular station life and the subsequent ability for free time between calls. Instead of being able to be sleeping in the station beds at night and respond from their home base crews are deployed to other stations or locations where service levels can be augmented. This concept is also stated in the article by Alanis et al where they identify that repositioning policies pose an issue for EMS staff due to the increased time spent in vehicles, increased workload and the potential for increased health concerns related to back injury and stress (Alanis, Ingolfsson, & Kolfal, 2013, p. 216).

Redeployment controversy also exists amongst the fire service as more negative feelings and attitude. Kolesar and Walker noted that successive redeployments, which cause double the companies to move, also cause increased angst and lower morale within firefighters. Firefighters being moved from their home stations where they cook, have personal items, and live in conjunction with communications and control problems were cited as reasons to move away from successive moveups in FDNY (Kolesar & Walker, 1974, p. 256). This article also noted that keeping the distance of relocation shorter was less stressful on the crews and keeping crews in areas where they were more familiar with the areas was beneficial in regards to situational awareness related to risk.

In summary, the literature review conducted by the researcher demonstrated that improving response performance to meet changing service demands was an ongoing issue for emergency services and not just the fire service. A variety of methods have been looked at to improve performance but common to most was the idea that flexible or dynamic deployment over and above traditional static deployment was necessary based upon the changing risks to areas served and service demands that arise above the planned risks. The review also showed that this concept of redeployment was not popular amongst the crews involved for a variety of reasons but taking crews away from “their” station and all that means was at the root of the unwillingness.

Procedures

This applied research project was based on the identification of data that would lead CFD to a decision as to whether to adopt the risk based deployment model being piloted or to revert back to the previously used traditional model and conduct more research. In order to reach this objective, this researcher used an evaluative research method to compare the performance results from 2013 under the traditional model to the performance results of 2014 under the piloted model. A survey was also utilized to gain an understanding of the strengths, challenges, and areas for improvement of the piloted model.

Using evaluative research, this project was designed to evaluate the performance at the 90th percentile of the first-due unit at fire/rescue, life-threatening emergency medical, and the 90th percentile at the effective response force (ERF) incidents at the station and overall department level between the 2013 and 2014 year to date timeframes aligned with the trial period of the pilot. Only travel time (travel time is defined as: begins at enroute notification by the officer and ends when officer acknowledges that unit arrived at location dispatched to) performance was evaluated as the variable between the traditional model and the pilot model as call time and turnout time performance processes were not being changed or altered as a result of the pilot. If the pilot model is deemed to be successful, there should be a decrease in travel time and an increase in the percentile performance towards the long term benchmark of 90th percentile. This would mean that the pilot model is a more effective response performance model than the traditional model used and that would be a service level improvement to the citizens.

How does the pilot model compare to the standard model in relation to the Fire/Rescue first due unit response time performance target?

How does the pilot model compare to the standard model in relation to the Life-Threatening Emergency Medical first due unit response time performance target?

How does the pilot model compare to the standard model in relation to the Fire Effective Response Force response time performance target?

To answer the first three questions related to the problem statement, data was pulled from the CFD records management system and analyzed in regards to system performance. In order to do this the researcher met with the performance analysts that work in the CFD Strategic Services section and described the research project, needs and outcomes required. The following procedures were used by the analysts to get the system performance data and provide the information to the researcher. Travel times are calculated looking at data from CFD's internal database of emergency and non-emergency incidents called FireRMS. This internal database (FireRMS) is automatically populated via the CAD dispatch system, facilitated by the Public Safety Communications Centre (PSC):

1) Time stamps are transferred from the CAD on an almost live basis to FireRMS (at five minute intervals).
2) In particular time stamps used for calculating travel time use data populated automatically by CAD via the Imobile (a wireless on-board computer system that all Fire Department uniformed personnel is trained on).
3) At the time of departure, an officer simply presses the *ENROUTE STATUS BUTTON* on the Imobile user-friendly interface to record the time stamp for later analysis. This time stamp is transmitted directly to the CAD and then on to FireRMS. This time recording method is used to establish a time stamp for all apparatus regardless of location (leaving the station or from another location) so that as much data as possible can be included in the turnout time calculation.
4) Upon arrival, at the location dispatched to, an officer then presses the ARRIVE STATUS BUTTON on the Imobile and this time stamp is also immediately transmitted to CAD and then on to FireRMS.

5) Timestamps are recorded both in the CAD and FireRMS as YYYY/MM/DD HH:MM:SS using the 24 hour clock.
6) FireRMS then compiles this data to accurately establish time stamps for a number of different time points during an incident. Multiple timestamps for an incident can be logged as each apparatus records their enroute, arrive and clear timestamps via the Imobile.

After time stamps are logged, an R&D Analyst reviews a sample of timestamps for priority incidents compiled on FireRMS monthly to make sure time stamps are accurate and to ensure that correct anecdotal information describing each incident is accurately entered. Approximately 5-10% of all incidents are reviewed, as are all priority incidents with a travel time of greater than 500 seconds. Once this QA process is complete, timestamps cannot be changed or altered during the calculation process. CFD also mitigates human error by ensuring that only analysts (less than four people) have access to raw timestamp data and data is not changed or altered once calculations have begun by an analyst. The next step in the process involved establishing Valid Time Responses. They are calculated by first extracting apparatus response data for 2013 and 2014 from FireRMS using Crystal Reports.

Crystal reports is a business intelligence application used by CFD to design and generate reports from the FireRMS database. Crystal reports uses SQL base programming to design the process for data extraction. Crystal reports calculates travel time by subtracting the enroute time from arrive time and formatting the responses in seconds. The raw data is then exported from Crystal Reports to Excel and SPSS file format for analysis. During this extraction, specific queries are run to ensure that only data is used where incidents occurred within Calgary city limits and that these incidents were categorized as hot incidents. Hot incidents are those that are coded by the dispatcher as requiring a priority response and thus the CFD would make every effort to respond to this type of call as quickly as possible. However, times are included for responses regardless of whether the apparatus is starting from quarters or not.

Further, for first-in unit analysis, only data for the first-in unit to arrive on-scene (as identified by the Incident Commander who completed the report) is extracted as first-in responses are the foundation of most of CFD's response time performance measures (turnout, travel, and total time components). It is worth noting that the first arriving unit is not always an engine though in most cases it is; while an engine responds to virtually every incident, there is the odd incident to which an engine is not dispatched. After incidents are selected from the FireRMS database, CFD aims to further limit the number of invalid response times that are used for response time analysis. While CFD uses a number of monthly quality assurance reports, in combination with FireRMS training and regular communications through interdepartmental *FD Notices* as issues arise, to ensure accurate response time data, response times can be invalid due to a variety of reasons. These include the following scenarios: a) due to the way FireRMS imports time stamps from CAD, in the case of a unit being dispatched initially, and then sent back later, the later time stamp is always imported into FireRMS, b) human error can also result in inaccurately logged time stamps. An officer, who forgets to hit the *ENROUTE STATUS BUTTON* or *ARRIVE STATUS BUTTON* but is later contacted by dispatch to confirm the unit is enroute or has arrived, may at that point push the *button* (this may be much later than when the unit actually departed from the station). While officers are trained to avoid doing this, it is likely still happening in some cases (though the incidence of this type of error has likely decreased over the past few years as instruction and communication on this point have increased), c) in addition, valid time stamps are designed to exclude the wrong unit identified as first arriving unit and a unit inaccurately checked as responding hot when it actually responded cold and therefore should not be included in the analysis.

To limit the number of these invalid responses, upper and lower response time limits are used for the turnout time component to eliminate likely invalid responses. Upper limits are based on historical response time analysis as well as quality assurance reviews on sample data sets. For first-in unit responses, upper limits are 2.5 standard deviations above the mean of historical data, rounded to the nearest minute. Upper valid limits are typically the point at which a maximum of 3-5% of all responses were above. For first-in unit travel time responses, valid lower limits are set as any response less than 0 seconds and valid upper limits are any response greater than or equal to 19 minutes. Once valid travel times are established, formulas for calculation of these times are used in Excel using the count, percentage and 90th percentile functions and are as described in Figure 1. The extraction of data is done for both time periods, the traditional model prior to dynamic deployment pilot implementation and post dynamic deployment implementation and the comparison of these two analyses shows the correlation between overall system performance and the implementation of the pilot.

For ERF analysis (the accumulation of a full first alarm assignment at a building structure fire incident), selection of incidents and apparatus responses are done manually by reviewing all code 111 incidents (building/structure fire incidents) on a monthly basis. These are first extracted using Crystal Reports into Excel using the following parameters: a) apparatus responses within Calgary city limits, b) hot Apparatus responses, c) apparatus responding both from quarters and not, and d) only apparatus responding to building/structure fire incidents (type 111). The selection of incidents is then narrowed down to only those where there are complete data to allow the determination of the four initially dispatched units which include two engines, an aerial, and a rescue (all dispatched hot). The resulting revised worksheet will show only those incidents where complete data exists to evaluate both travel and total response time for the full first alarm, approximately 8-12 incidents per month. Apparatus responses are eliminated if they are not an engine, aerial or rescue unit; or if they do not have a valid enroute or arrive time (every one of the four units to be included in the response time calculation for a particular incident must have an enroute time and an arrive time). Incident responses are then eliminated that do not contain the four specific units needed for the response time analysis.

First-in Unit Calculations	**Formula**
Valid TRAVEL Time Responses	=COUNT(XX:XX)
Responses within 4:30 (270 sec) TRAVEL time	=COUNTIF(XX:XX,"<=270")
% within 4:30 (270 sec) TRAVEL time	=Responses within 4:30 Travel Time /All Valid Travel Time Responses
90th Percentile TRAVEL Time (seconds)	=PERCENTILE(XX:XX,0.9)
90th Percentile TRAVEL Time (mm:ss)	=TIME(,,XX)

Figure 1. Formulas used for travel time performance calculations. Provided from CFD Strategic Services.

Response times are then aggregated to only include the earliest enroute time of all four apparatus and the latest arrive time of all four apparatus. Travel time is then calculated for each incident with the formula latest arrive time minus earliest enroute time. From the calculated response time fields, response times are converted in seconds, then valid upper limits are applied (i.e., exclude travel times over 16 minutes). Cell formulas similar to first-in unit (see Figure 1) are applied to show detailed results within the 8 minute 30 second (510 second) travel time: total valid responses, responses within the time objective time (number and percent), and 90th percentile.

What modifications to the pilot could be made to improve response time performance if target areas were not achieved?

What perceived challenges and strengths exist to adopting the pilot model?

To answer questions #4 and #5, a survey was compiled and distributed amongst CFD staff that has a part to play in the use of or application of the dynamic deployment pilot. The researcher worked with the CFD Supervisor Research & Accreditation Erin Corrigan, to draft and format a survey using FluidSurveys. The intent of the survey was to gather information from users as to what parts of the pilot are working well, what parts are not working well and what improvements may be needed to make the pilot work better. The survey utilized a combination of forced choice and closed-ended questions to get an understanding of the effectiveness of the pilot and also used a small number of open-ended questions to get information on what might make the pilot more successful. The survey was drafted to ensure anonymity of respondents and was sent to a total population of 48 uniformed FET members, Chief Officers (that includes Battalion Chiefs and District Chiefs), and Qualified District Chiefs. The participant group was identified as the officers that implement the dynamic deployment pilot model and are responsible for application of it in the field. This is the group that organizes the movement of apparatus for covering in other stations and identifies the need for coverage due to emergency response demands. The survey questions and formatting are described in Appendix A.

On November 4, 2014, an email (see Appendix B) was sent to all identified participants in the target population by Erin Corrigan, CFD Supervisor Research & Accreditation asking for their participation in the survey and identifying the reason for the survey and benefits. It was decided by the researcher that the survey request would be better coming from the supervisor rather than the researcher (Interim Fire Chief) as to not put an alternative motive or added pressure on the participants. The survey was identified to be open for enough time for all four platoons to have time to respond, approximately eight days. On November 13, 2014, a follow up email (see Appendix C) was sent by the researcher to encourage all those participants that had not completed the survey to complete it. The survey was officially closed on Tuesday November 18, 2014 and the results and data from the survey were compiled by the CFD Supervisor Research & Accreditation and provided to the researcher for use in the project.

There are of course limitations that exist in relation to this research paper. First, with regards to the information coming from the CAD and the FireRMS data, limitations exist with the number of valid incidents and time stamps that are provided within the system. Time stamps are provided by the actions of people and therefore the validity is assumed to be correct and that the officers are all following proper procedures on when to acknowledge enroute and arrival time stamps. Another system limitation is the effect that a station’s low call volume can have on the deviation of the percentile performance. The lower the call volume the more of an impact an individual call can have on overall performance. In regards to the survey, limitations exist in the way that the questions are answered and the effect that an individual can have on the results based on their perception, biases and motives. This researcher assumed that the respondents all answered the survey based on the questions asked and only for the purposes of the research. Another limitation related to the survey is that with a total population size of 48 and only 41 responses, the confidence level is just below the 95% that is recommended in the applied research course guide (United States Fire Administration, 2013, p. 35).

Results

The procedures followed for this research project led to findings that are relevant to this paper and the research questions posed by the researcher.

How does the pilot model compare to the standard model in relation to the Fire/Rescue first due unit response time performance target?

Utilizing the procedures identified in the previous section of this ARP and valid, geocoded responses only, data was drawn for each first-due district from the FireRMS database for all hot response fire/rescue incidents for each year of 2013 and 2014. The results for this analysis are shown in Table 1 and vary amongst each first-due district. The analysis identifies that in 2014 utilizing the dynamic deployment pilot model, 21 first-due districts out of a total of 39 showed an increased response performance percentile and 24 first-due districts showed an improved 90th percentile response travel time. It is also noteworthy that 19 of the first-due districts recorded a decrease in valid call volumes over the volumes recorded for 2013. When you compile the individual first-due district data and look at the results from a system wide perspective, the response performance percentile improved 1.4% under the pilot model to 74.6% met the travel time target up from the 2013 level of 73.2% met. The system wide response travel time also improved by 11 seconds, reducing the 2013 90th percentile of 6 minutes and 1 second down to 5 minutes and 55 seconds in 2014.

Of the first-due districts where marked performance increases were identified using the pilot model, 60% of stations identified as critical stations were included in this group. Table 2 shows the comparison of total non-medical incidents between 2013 and 2014 by first-due district and identifies that the total call volume of non-medical, hot and cold responses in 2014 increased by 4,075 incidents or by 14.23%. Therefore, when looking at the data in Table 1 and Table 2, although total non-medical incidents were up in 2014 the number of valid fire/rescue responses in 2014 decreased by 242.

Table 1

Fire/Rescue Incidents Travel Time by first-due district, 2013 vs. 2014

Priority Fire/Rescue Incidents
First-in unit Percentage of Responses within 4:30 Travel Time by first-due district, 2013-2014

First-due district	2013 # of Valid Responses	2013 Jan 01 - Nov 30 % within 4:30	2013 90th Percentile Performance	2014 # of Valid Responses	2014 Jan 01 - Nov 30 % within 4:30	2014 90th Percentile Performance	# of Valid Responses Change	% Change Response Performance	Change 90th Percentile Performance
1*	605	78.5%	6:01	436	87.8%	5:02	-169	9.3%	0:59
2*	349	87.4%	4:57	303	94.7%	4:03	-46	7.3%	0:54
4*	255	68.6%	6:00	224	68.3%	6:26	-31	-0.3%	-0:26
5	232	86.2%	5:12	183	82.0%	5:37	-49	-4.2%	-0:25
6	336	92.0%	5:20	318	95.0%	4:43	-18	3.0%	0:37
7	155	88.4%	4:58	131	84.7%	5:11	-24	-3.7%	-0:13
8	200	87.0%	5:13	196	85.7%	5:50	-4	-1.3%	-0:37
9	131	57.3%	7:34	96	64.6%	6:15	-35	7.3%	1:19
10	331	81.6%	5:19	285	84.6%	5:29	-46	3.0%	-0:10
11*	246	72.4%	6:22	273	70.3%	6:43	27	-2.0%	-0:21
12*	351	77.5%	5:34	337	77.2%	5:22	-14	-0.3%	0:12
14*	287	75.6%	6:18	239	77.8%	6:51	-48	2.2%	-0:33
15	126	73.8%	5:55	153	77.1%	5:36	27	3.3%	0:19
16	84	85.7%	6:06	92	84.8%	6:27	8	-0.9%	-0:21
17	144	79.2%	5:34	162	73.5%	6:00	18	-5.7%	-0:26
18	210	68.6%	6:57	197	74.6%	6:03	-13	6.0%	0:54
19	103	79.6%	6:36	126	75.4%	6:11	23	-4.2%	0:25
20	86	59.3%	7:02	126	61.1%	7:14	40	1.8%	-0:12
21*	171	45.6%	7:20	200	56.5%	7:15	29	10.9%	0:05
22*	307	68.4%	6:02	298	67.4%	6:07	-9	-1.0%	-0:05
23*	289	68.5%	6:27	224	73.2%	6:11	-65	4.7%	0:16
24	139	67.6%	6:27	135	72.6%	6:14	-4	5.0%	0:13
25	115	64.3%	7:14	167	68.9%	7:41	52	4.5%	-0:27
26	223	63.7%	6:25	248	66.5%	6:24	25	2.9%	0:01
28	123	63.4%	6:06	126	54.8%	5:44	3	-8.7%	0:22
29	78	76.9%	5:25	75	61.3%	6:10	-3	-15.6%	-0:45
30*	206	73.8%	6:12	235	68.5%	5:55	29	-5.3%	0:17
31	165	75.8%	5:56	172	79.7%	5:34	7	3.9%	0:22
32	120	92.5%	4:29	128	85.9%	5:00	8	-6.6%	-0:31
33	137	56.2%	6:21	142	67.6%	6:06	5	11.4%	0:15
34	102	57.8%	7:05	140	57.9%	7:01	38	0.0%	0:04
35	49	61.2%	7:45	23	87.0%	5:18	-26	25.7%	2:27
36	72	80.6%	6:29	52	69.2%	6:13	-20	-11.3%	0:16
37	133	82.7%	5:29	93	74.2%	5:43	-40	-8.5%	-0:14
38	75	30.7%	9:56	92	23.9%	9:34	17	-6.8%	0:22
39	117	47.0%	7:39	129	55.8%	6:55	12	8.8%	0:44
40	67	71.6%	6:52	105	69.5%	6:47	38	-2.1%	0:05
41	80	1.3%	8:56	96	63.5%	6:01	16	62.3%	2:55
Citywide	6,999	73.2%	6:01	6,757	74.6%	5:50	-242	1.4%	0:11

Source: FireRMS geocodable data (Please note all incident responses that can geocoded to a location with Calgary city limits have been included in this analysis). *NO SEPT 9-11 2014 – Due to major snowstorm abnormal event
* Critical Station

Table 2

Total Number of non-medical Incidents by first-due district, 2013 vs. 2014

Total Number of Non-Medical Incidents by first-due district (Jan-Nov), 2013-2014			
First-due district	2013 # of Incidents	2014 # of Incidents	# of Incidents Change
1*	2,089	2,062	-27
2*	1,197	1,250	53
4*	990	1,054	64
5	723	1,028	305
6	953	1,036	83
7	557	893	336
8	825	1,179	354
9	609	476	-133
10	944	1,304	360
11*	1,006	1,254	248
12*	1,154	1,233	79
14*	1,012	1,303	291
15	444	693	249
16	291	376	85
17	563	822	259
18	745	877	132
19	373	543	170
20	429	692	263
21*	637	714	77
22*	1,314	1,351	37
23*	1,011	1,056	45
24	474	594	120
25	294	373	79
26	808	885	77
28	431	464	33
29	304	341	37
30*	668	760	92
31	603	642	39
32	400	428	28
33	466	445	-21
34	335	414	79
35	181	85	-96
36	245	274	29
37	398	385	-13
38	243	305	62
39	365	394	29
40	221	295	74
41	246	342	96
Citywide	24,548	28,623	4,075

Source: FireRMS geocodable data (Please note all incident responses that can geocoded to a location with Calgary city limits have been included in this analysis).
* Critical Station

How does the pilot model compare to the standard model in relation to the Life-Threatening Emergency Medical first due unit response time performance target?

The data pulled from the FireRMS system related to first-due district travel time response and performance for life threatening emergency medical incidents is similar to the fire/rescue data. The data varies from station to station; an increase in performance does not mean that there was an improvement in travel time and a reduction in valid responses does not mean that there was a drop in performance. Table 3 lists the breakdown of data by first-due district for hot, valid, geocoded responses to life threatening emergency medical incidents between 2013 and under the pilot model in 2014. The analysis demonstrates that in 2014 using the dynamic deployment pilot model, 25 first-due districts out of a total of 39 improved their percentile response performance however only 18 first-due districts experienced an improvement in their 90th percentile response travel time. Even more first-due districts experienced a drop in valid responses in 2014 over 2013 for life threatening emergency medical calls than fire/rescue with 24 stations logging decreased responses. From a system wide performance perspective, the dynamic deployment pilot model resulted in an improvement of percentile target performance met of 1.7% to 79.9% up from 78.2% in 2013. The system also saw the 90th percentile response travel time improve by 6 seconds decreasing to 5 minutes and 21 seconds.

Of the 25 first-due districts where performance increases occurred using the pilot model, 70% of stations identified as critical stations saw increased performance. Table 4 shows that the total hot and cold medical incidents between 2013 and 2014 by first-due district rose in 2014 by 1,219 incidents or 4.68%. Therefore when looking at the data in Table 3 and Table 4, although total medical incidents were up in 2014 the number of valid life threatening emergency medical responses in 2014 decreased by 2,511.

Table 3

Life threatening emergency medical Incidents Travel Time by first-due district, 2013 vs. 2014

Priority Life Threatening Emergency Medical Incidents
First-in unit Percentage of Responses within 4:30 Travel Time by first-due district, 2013-2014

First-due district	2013 # of Valid Responses	2013 Jan 01 - Nov 30 % within 4:30	2013 90th Percentile Performance	2014 # of Valid Responses	2014 Jan 01 - Nov 30 % within 4:30	2014 90th Percentile Performance	# of Valid Responses Change	% Change Response Performance	Change 90th Percentile Performance
1*	591	84.8%	5:00	930	87.0%	4:51	339	2.2%	0:09
2*	253	90.9%	4:19	282	94.0%	3:50	29	3.1%	0:29
4*	302	75.8%	5:33	272	80.5%	5:45	-30	4.7%	-0:12
5	256	90.2%	4:30	194	91.8%	4:31	-62	1.5%	-0:01
6	251	95.2%	3:55	329	95.7%	3:48	78	0.5%	0:07
7	324	90.1%	4:30	249	89.2%	4:35	-75	-1.0%	-0:05
8	488	87.3%	4:50	460	89.1%	4:39	-28	1.8%	0:11
9	333	63.7%	6:07	163	71.2%	5:26	-170	7.5%	0:41
10	408	89.2%	4:33	402	89.6%	4:41	-6	0.3%	-0:08
11*	369	76.4%	5:41	507	82.8%	5:23	138	6.4%	0:18
12*	946	80.0%	5:17	834	82.0%	4:58	-112	2.0%	0:19
14*	516	81.6%	4:55	432	78.0%	5:31	-84	-3.6%	-0:36
15	341	80.1%	5:38	320	79.4%	5:42	-21	-0.7%	-0:04
16	33	81.8%	6:19	42	66.7%	7:15	9	-15.2%	-0:56
17	385	76.4%	5:19	263	74.5%	5:21	-122	-1.8%	-0:02
18	368	78.5%	5:35	360	80.3%	5:36	-8	1.7%	-0:01
19	253	78.7%	5:34	199	79.4%	5:18	-54	0.7%	0:16
20	228	69.7%	5:40	276	68.1%	5:44	48	-1.6%	-0:04
21*	344	57.8%	6:35	417	64.7%	6:32	73	6.9%	0:03
22*	667	75.4%	5:21	579	73.1%	5:23	-88	-2.4%	-0:02
23*	565	87.1%	4:56	539	85.3%	5:34	-26	-1.7%	-0:38
24	235	77.0%	5:11	223	74.0%	5:44	-12	-3.0%	-0:33
25	100	77.0%	5:40	87	77.0%	6:25	-13	0.0%	-0:45
26	473	74.4%	5:46	422	75.1%	5:36	-51	0.7%	0:10
28	252	72.6%	5:35	209	63.2%	5:48	-43	-9.5%	-0:13
29	129	65.9%	5:31	108	70.4%	5:37	-21	4.5%	-0:06
30*	251	77.3%	5:40	248	77.8%	5:19	-3	0.5%	0:21
31	214	79.9%	5:41	279	81.7%	5:17	65	1.8%	0:24
32	350	91.1%	4:24	365	87.1%	4:51	15	-4.0%	-0:27
33	158	64.6%	5:59	196	72.4%	5:54	38	7.9%	0:05
34	218	60.1%	5:36	205	60.0%	6:22	-13	-0.1%	-0:46
35	87	66.7%	6:22	48	97.9%	4:04	-39	31.3%	2:18
36	169	84.6%	5:00	144	88.9%	5:01	-25	4.3%	-0:01
37	260	86.5%	4:41	227	85.9%	4:43	-33	-0.6%	-0:02
38	98	35.7%	9:50	124	41.9%	9:28	26	6.2%	0:22
39	114	32.5%	6:38	108	39.8%	7:10	-6	7.4%	-0:32
40	119	58.8%	6:31	150	76.7%	6:23	31	17.8%	0:08
41	45	6.7%	7:31	54	74.1%	6:09	9	67.4%	1:22
Citywide	11,493	78.2%	5:27	8,982	79.9%	5:21	-2,511	1.7%	0:06

Source: FireRMS geocodable data (Please note all incident responses that can geocoded to a location with Calgary city limits have been included in this analysis). *NO SEPT 9-11 2014 – Due to major snowstorm abnormal event
* Critical Station

Table 4

Total Number of medical Incidents by first-due district, 2013 vs. 2014

Total (All Card Types) Number of Medical Incidents by FDD (Jan-Nov), 2013-2014			
First-due district	**2013 # of Incidents**	**2014 # of Incidents**	**# of Incidents Change**
1*	1,911	2,698	787
2*	966	1,088	122
4*	959	821	-138
5	495	474	-21
6	711	758	47
7	553	566	13
8	951	862	-89
9	574	389	-185
10	847	905	58
11*	857	1,008	151
12*	1,684	1,653	-31
14*	1,195	1,205	10
15	608	576	-32
16	105	141	36
17	667	623	-44
18	797	835	38
19	424	446	22
20	522	538	16
21*	751	843	92
22*	1,675	1,775	100
23*	1,191	1,156	-35
24	508	680	172
25	172	159	-13
26	849	869	20
28	469	483	14
29	264	257	-7
30*	548	537	-11
31	636	634	-2
32	564	623	59
33	331	343	12
34	397	343	-54
35	164	91	-73
36	299	321	22
37	398	398	0
38	273	318	45
39	213	228	15
40	195	251	56
41	115	162	47
Citywide	24,838	26,057	1,219

Source: FireRMS geocodable data (Please note all incident responses that can geocoded to a location with Calgary city limits have been included in this analysis).
* Critical Station

Table 5

Comparison of Fire/Rescue and Life threatening emergency medical incidents 2013 vs. 2014

Priority First-In Unit Response Time Goals				2013 Year-to-Date Total Jan-Nov		2014 Year-to-Date Total Jan-Nov		Change 2013-2014	
Dispatch Type and Time Component		**Goal Time (mm:ss)**	**2014 Target**	**90th Percentile**	**% met goal**	**90th Percentile**	**% met goal**	**90th Percentile**	**% met goal**
Fire/ Rescue	Travel	4:30	No Target	6:01	73.2%	5:50	74.6%	-11 seconds	+1.4%
Emergency Medical	Travel	4:30	No Target	5:27	78.2%	5:21	79.9%	-6 seconds	+1.7%

Table 5 shows the comparison of performance percentile meeting targets and 90th percentile travel time of both fire/rescue incidents and life threatening emergency medical incidents. In both areas of performance, the dynamic deployment pilot model achieved performance and travel time improvements over the traditional model used in 2013. It should be documented that this performance improvement although only between 1-2%, was achieved when there were significant increases to total incident calls for both non-medical and medical incidents which when combined totalled an increase of 5,294 incidents over 2013.

How does the pilot model compare to the standard model in relation to the Fire Effective Response Force response time performance target?

The results from analysis of FireRMS data for ERF performance are dramatically different than that of the first-due district responses and are provided in Table 6. The 90th percentile travel time actually increased by two seconds using the pilot model over the traditional model but the percentile performance meeting the target increased by 10.5% using the pilot model in 2014. It should be noted that for both 2013 and 2014 ERF data there was only 105 and 101 valid responses respectively. The low number of responses to base analysis on means that the impact of each valid response can be that much more significant than if higher call volumes were available. The individual 90th percentile travel time remained virtually unchanged between deployment models however; the overall system performance increase was significant demonstrating that the pilot model utilized in 2014 had a definite positive impact on ERF performance across the city.

Table 6

Travel time performance of ERF 2013 vs. 2014

Full first alarm assignment response time performance Fire suppression incidents			2013 Year-to-Date Total Jan-Nov (105 Valid Responses)		2014 Year-to-Date Total Jan-Nov (101 Valid Responses)		Change 2013-2014	
	Goal Time (mm:ss)	**2014 Target**	**90th Percentile**	**% met goal**	**90th Percentile**	**% met goal**	**90th Percentile**	**% met goal**
Travel	8:30	No target	11:40	52.9%	11:42	63.4%	+0:02	+10.50%
Total	11:00	70%	14:34	59.0%	14:11	63.4%	-0:23	+4.40%

In answer to research questions #4 and #5, the survey conducted provided feedback results that have led to findings that will be expanded on in the discussion and recommendation sections of this paper. All survey results are listed in their entirety in Appendix D.

What modifications to the pilot could be made to improve response time performance if target areas were not achieved?

In the survey, question #10 asked how easy it was to use the apparatus redeployment table provided to Officers to help make their coverage decisions. Only 2 respondents or 6.2% of those that answered rated the ease of use as a 4 (1 being not easy and 10 being very easy) or lower. Of the respondents that identified that the table was not easy to use, the responses as to why given were that a computer available to the officers to see where apparatus were would be beneficial and that the table restricted the movement of certain apparatus.

In question #12, respondents were asked if they were following the identified guidelines including the use of second engine rules. The results from that question identified that 9 respondents or 28.1% of those surveyed answered no, that they were not following the guidelines. The reasons given by all of the respondents that stated they did not follow the guidelines were related to having the ability to use the second engines located at some critical stations. They stated that the use of some second engines should be allowed within the guidelines.

Another question asked that related to modifications to the pilot model was question #18 that asked if automating the process for day-to-day moves would help apply the guidelines (See Figure 2). Of the respondents that replied to this question, 20 respondents or 69% answered no. The breakdown of these answers was provided in question # 19 and is seen in Figure 3 but the two main themes given by those that answered no were that not automating the process would allow it to remain dynamic and flexible and that there are too many variables for an automated model.

Response	Chart	Percentage	Count
Yes		31.0%	9
No		69.0%	20
		Total Responses	**29**

Figure 2. Survey response for Question #18.

Response	Chart	Percentages	Count
Too many variables for automated model		44%	12
Automating would allow guidelines would be consistently applied		25%	7
Not automating would allow system to be dynamic		22%	6
Automating model would decrease work load		7%	2
Other		3%	1

Figure 3. Breakdown of responses to Question #19.

Finally, question #20 asked participants if they had comments or suggestions for improvement of the pilot model. All responses are listed in Figure 4; however of the suggestions provided there were two themes directly related to improving the model: a) utilize the second engines that are located in some critical stations and b) limit the cascading of apparatus to within one or two districts from an apparatus' home station.

What perceived challenges and strengths exist to adopting the pilot model?

The survey utilized in this research paper asked questions that can be used directly to answer research question #5. Survey question #2 asked participants to rate the overall implementation of the dynamic deployment pilot model and of the responses given as shown in Figure 5, 33 respondents or 80.5% gave the pilot a rating of 6 (1 being not at all satisfied and 10 being very satisfied) or higher while 5 respondents or 12.1% gave a rating of 4 or less. A rating of neither satisfied nor dissatisfied was given as a response by 3 respondents or 7.3%.

#	Response
1.	no
2.	Good overall product.
3.	no
4.	No.
5.	Not sure that's its necessary for the CFD to employ 2 x CFD members up at PSC, when we as District Chiefs are more than capable of doing this job. It would be a significant cost savings.
6.	I feel as long as there are available engines in the stations 12, 22, 23 only one of the stations need maintain a second engine, as they cover each other and are in relative proximity to each other. 5 engines is overkill. I feel R32 is not required in the north as with the opening of Stoney Trail R31 and R4 can cover the area completely. R32 would be better served in the SW eg. 20stn
7.	Thank you for evaluating our performance. Thank you for using a risk management approach in this evaluation process. Thank you for educating us on how we can affect better overall response by reducing our chute times, while NOT (simply) trying to drive faster to calls. Thank you for including an educational approach to this deployment implementation. It helps when we can better understand WHY we are doing something, and what the objectives are. Thank you for striving for all of us to give better service to Calgarians and our visitors. Thank you for asking our opinion and input.
8.	Staff auxiliary rigs appropriately and the current model works well. Otherwise, I would recommend that we go back to covering stations with an engine from a 2 engine hall.
9.	The only complaint I hear from officers is that they don't have an engine on their neighboring halls. An aerial covering #9 is not comfortable when there is a Haz mat covering # 25.
10.	Get the people on the floor involved we are the ones using the system ,
11.	Firefighter and public safety, proper equipping, and funding of a Fire Department should be based on proven well documented research. I have yet to see any support from any recognized fire service governing body that supports our deployment model.
12.	Utilizing the Second Engines during evenings and week ends
13.	No
14.	Utilize the second engines, I experienced many years of the "squad" model and it worked well, on the rigs themselves as a driver, a captain and as a records officer utilizing for coverage for both training and events. All through this I can' remember a time when there were issues as a result when that second engine wasn't available within their regular district. Maybe we should look at when these second engines are utilized we back fill with a secondary rig if they don't already have one to offset coverage required if the other engine was to get a call.
15.	Cascading should be limited to 1 or 2 districts over so that crews have a general knowledge of the area as opposed to moving units clear across the city.
16.	After quality information and training for all those involved, trust your people.
17.	Would benefit from software to recommend the moves to take away from humans doing it less consistently
18.	No
19.	Overall, I believe that the DDM is beneficial and has provided the citizens of Calgary better service from the CFD
20.	I WOULD LIKE TO SEE SOME STATISTICS ON CRITICAL STATIONS WITH 2 ENGINES. HOW OFTEN DOES A CALL COME IN FOR THE SECOND ENGINE WHEN THE FIRST ENGINE IS OUT.

Figure 4. Responses to survey question #20.

Response	Chart	Percentage	Count
1 - Not at All Satisfied		2.4%	1
2		4.9%	2
3		2.4%	1
4		2.4%	1
5 - Neither Satisfied Nor Dissatisfied		7.3%	3
6		9.8%	4
7		19.5%	8
8		26.8%	11
9		19.5%	8
10 - Very Satisfied		4.9%	2
Not Applicable		0.0%	0
		Total Responses	**41**

Figure 5. Survey results for Question #2.

As part of the inquiry in question #2, question #3 provided responses that identify both challenges and strengths of the pilot model. The themes as shown in Figure 6, which came out of these responses related to strengths, were: a) better coverage to minimize risk, b) more flexibility for training and events and c) better resource utilization. The themes that were identified related to challenges to the pilot model were: a) need to use second engines, b) moving more apparatus than necessary and c) using secondary apparatus staffed with only two firefighters.

Response	Chart	Percentages	Count
Better coverage to minimize risk		22%	8
Satisfied		22%	8
Allows more flexibility for training, events, etc		16%	6
Need to be able to use second engines (Station 10 & Station 30 as alphas)		13%	5
Better Resource Utilization		8%	3
Moving more rigs than necessary		5%	2
Other		30%	11

Figure 6. Survey results for Question #3.

Question #16 asked respondents to identify three things that the pilot has succeeded at while #17 asked respondents to identify three things to improve the pilot model. As listed in Figure 7, the top four themes identified as successes were: a) increasing community coverage, b) giving junior officers opportunities to better use skills, c) consistent guidelines provided and d) faster responses. Figure 8 provides the list of themes related to improving the pilot and lists the top four themes as: a) use of second engines, b) formalized/automated system to move apparatus, c) staff secondary apparatus with additional firefighters and d) increased education / communication.

Response	Chart	Percentages	Count
Increasing community coverage		62%	17
Gives junior officers a chance to better utilize skills		44%	12
Basic/ Consistent guidelines (easy-to-follow)		29%	8
Faster response		29%	8
Better utilization of resources		22%	6
Easier to schedule training		18%	5
Other		11%	3

Figure 7. Survey results for Question #16.

Response	Chart	Percentages	Count
Allow more flexible use of second engines (squad model)		44%	11
Formalized/automated system to move units		36%	9
Staff auxiliary rigs with additional manpower		16%	4
Increased education/ communication about the model		12%	3
Other		64%	16

Figure 8. Survey results for Question #17.

The results provided from the data analysis and the evaluative research done in conjunction with the survey responses were able to provide answers to all five research questions posed by this ARP. The evaluative research identified that the dynamic deployment pilot model instituted in 2014 has improved system performance in all three measures of fire/rescue, life threatening emergency medical and effective response force travel time performance. Further, the results from the survey responses of users of the pilot model has demonstrated that although the pilot has some positive strengths such as increasing coverage, faster responses and better use of resources there are some challenges and room for improvement of the model such as better use of second engines, limits to cascading of apparatus and better education and communication of the model.

Discussion

The goal of this ARP was to conduct evaluative research in order to aid the Fire Executive Team in decision making around the adoption of a deployment model for maximum performance delivery. The first finding from this research was that the dynamic deployment pilot model being used by CFD has resulted in improvements to the system response performance over the traditional static model used previously. This result supports the research done by Ignall et al (1975) that was conducted in New York with the FDNY. Ignall and his co-authors determined that the key to relocation of resources to help improve response times was based on the risks associated with call volumes and probability of additional calls coming in to each specific first-due district across the city. The results shown from Tables 1 and 2 identify that the majority of stations that were identified by CFD as critical stations (those with higher risks due to call volumes and higher probability of additional calls), showed increases in performance in both fire/rescue and life threatening emergency medical response travel times. This finding is also aligned with the work done as part of standards of cover work through the CFAI accreditation process. Accreditation uses the principle that the understanding of risks throughout a community is key to the concentration and distribution of resources by a fire service (Center for Public Safety Excellence, 2008). This was a foundational layer to the pilot model used that sees engines relocated to the critical stations after approximately 20 minutes of no coverage in order to provide an in district response based on the risks of those stations.

The findings also support some of the literature reviewed related to EMS systems. Research done in Alberta demonstrated that performance improvements can be realized by using a repositioning model that balances the supply and demand of ambulances (Alanis, Ingolfsson, & Kolfal, 2013). The results from this ARP as shown in Tables 5 and 6 identifying that system performance for an ERF response improved by 10.5%, demonstrate that by following a dynamic deployment model based upon risks evaluated for each first-due district can improve response performance. Work done in the United Kingdom on redeployment revolved around the premise that redeployment can be beneficial up to a point (Peace, 2001). Peace identified that there needs to be an identified threshold that is the optimal level of coverage and when the performance gain is below that, relocation does not make sense. The results listed in Tables 1 and 3 validate the work by Peace as there were performance gains of various degrees but there were also performance drops in some first-due districts as a result of the dynamic deployment pilot. This indicates that for some stations, redeployment did not have a positive impact and may have actually caused a performance drop in stations that had their apparatus relocated as it is impossible to accurately predict all service demands.

The second finding from this ARP was that there is room for improvement to the pilot model. Results from the survey of CFD Chief Officers provided feedback that one concern was that too many apparatus are moving and they are moving too far for coverage. In research done for FDNY, it was concluded that the shorter the distance of the move combined with keeping crews in districts where they had some familiarity and knowledge of was less stressful and more acceptable to crews (Kolesar & Walker, 1974). The results from the CFD survey support this position. Feedback provided stated that five percent of respondents specifically identified that the pilot causes too many apparatus to move while included in the “other” category several responses also identified this as an issue and that the cascading of apparatus should be limited to one or two stations away from a crews’ home station.

Another improvement that was identified from the results of the survey is that the redeployment guideline tables need to be more flexible than hard fast rules. This is contrary to the work done by Alanis, Ingolfsson and Kolfal (2013) related to EMS redeployment. In their research, conclusions were drawn that a compliance table incorporated into a markov model could provide dispatchers with a tool to make decisions on ambulance redeployment to meet the dynamic service demands. The CFD results showed from a number of survey questions that the redeployment guidelines which restrict the use of second engines from five critical stations does not make sense to the Chief Officers who are making the decisions on coverage. The results from question #17 showed that 44% of the respondents believe improvement to the pilot model could be made by allowing use of the second engines for coverage. Therefore it can be hypothesized from the two pieces of research that compliance tables may be a benefit to identify the need and location for a redeployment, but not beneficial to identify the particular apparatus to be redeployed.

One set of results from the CFD survey were inconclusive on a suggested improvement to the pilot model. Question #18 results showed that 69% of respondents did not think that automating the process would be an improvement however; in question #17 which asked for three things that would improve the model, the second highest provided theme was for a formalized/automated system to move apparatus which was provided by 36% of the respondents. In the research done through Cornell University looking at a computerized approximate dynamic programming approach or ADP model, conclusions were given that the ADP computer model resulted in less subjective use of tables and therefore a single definitive decision opposed to multiple decisions from a table (Maxwell, Restrepo, Henderson, & Topaloglu, 2010). The Maxwell research was also supported in part by research done by Church, Sorenson and Corrigan (2001) that identified technology and specifically CAD, GPS and business intelligence software, as ways to meet optimal performance and achieve significant performance gains. This researcher sees this concept of automation as an area for further research that should be undertaken in the future as another phase of the pilot model.

The last finding that was supported by the research results was that the users see a number of benefits to using the pilot model and that this would support adoption of the new model. Question #16 results, as seen in Figure 7, identified that the users of the pilot model found seven themes that were labelled as successes of the pilot model. These included increased community coverage, more opportunities for junior officers, consistent application of the guidelines, faster responses, better utilization of resources, and allowing easier scheduling of training. This makes sense and is aligned with the work done by Heifetz and Linsky (2002). As the Chief Officers are the users of the pilot model but not necessarily those affected by the moves, they are not the ones that need to suffer a loss or give something up in regards to the traditional manner that they deploy to be supportive of an adaptive change (Heifetz & Linsky, 2002). Although, some of the comments provided in the open ended question did make references to the more traditional model and how things used to be as a better model, this too aligns with Heifetz and Linsky as their work discusses that moving away from tradition brings on feelings of betrayal and disloyalty to those that have come before us.

These results in conjunction with the work from Heifetz and Linsky would indicate that further research in regards to feedback from those impacted by the pilot model and redeployment may be needed in order to get a complete understanding of the effectiveness and satisfaction of the pilot. The further research may then be able to provide results that could then be compared to other work referenced in the literature review in regards to the morale and satisfaction of crews. In a 2012 *JEMS* article, it was noted that even though dynamic deployment had positive performance and citizen results, staff morale was lowered due to crews being drawn away from their home stations (Washko, 2012). Washko's work was supported by results that were identified in the works of Alanis et al (2013) where they concluded that staff stress levels increased with redeployment and the associated policies.

Recommendations

The purpose of this ARP was to determine if the current risk based deployment model being piloted in the CFD should continue and be adopted. This was done using an evaluative research method, a detailed literature review and original research work done through data analysis and use of a survey. The results of this ARP have led to specific recommendations regarding the adoption of the pilot model. The recommendations presented are:

- So as to allow more flexibility within the application of the redeployment guidelines, CFD should change the guidelines to allow the use of second engines; located in the five critical stations, in the coverage of other first-due districts.

- So as to reduce the stress of staff and ensure that redeployed crews have some knowledge of their coverage areas, CFD should change the guidelines to only redeploy apparatus one or two districts away from their home district.
- So as to reduce the number of redeployments necessary and improve the morale and satisfaction with the process, CFD should only require redeployment into those stations identified as critical stations.
- So as to ensure that the stations with increased risks are identified for redeployment consideration, CFD should undertake bi-annual risk and critical station analysis. This would align with the fact that risks and service demands are constantly changing.
- So as to solicit feedback from the crews impacted by the redeployment model not just users, CFD should conduct a survey of the frontline Officers that are the crews being redeployed in regards to their satisfaction and views of the model.

There are also some recommendations for future research related to the adoption of the pilot model. Other researchers, including those within CFD may want or need to replicate all or part of this research in order to conduct the research proposed. The recommendations for future research are:

- So as to ensure that there is a positive benefit or cost associated with conducting any redeployments, research should be conducted to establish a threshold limit of success that a performance gain can be evaluated against. This would allow analysis of stations where redeployment was a true success or where it is not warranted.
- So as to assess the subjective use of redeployment guidelines and tables and the potential of increased effectiveness of a redeployment model, further research should be conducted that looks at the automation of tables or move up software to replace manual applications.

As a result of the findings identified through the research results, this researcher has identified that the dynamic deployment pilot model currently being used should be adopted and continued within the CFD.

References

Alanis, R., Ingolfsson, A., & Kolfal, B. (2013). A Markov chain model for an EMS system with repositioning. *Production and Operations Management 22(1)* , 216-231. doi: 10.1111/j.1937-5956.2012.01362.x.

Calgary Fire Department. (2008). *Calgary Fire Department Service levels and response time targets.* Calgary, AB: City of Calgary.

Calgary Fire Department, Strategic Services. (2013). *Performance improvement programme - strategy D2.* Calgary, AB: City of Calgary.

Calgary Fire Department. (2014). *2014 Standards of cover.* Calgary, AB: City of Calgary.

Calgary Fire Department. (2014). *Calgary Fire Department 2013 Annual report.* Calgary, AB: City of Calgary.

Center for Public Safety Excellence. (2008). *CFAI Standards of cover, 5th Edition.* Chantilly, VA: Center for Public Safety Excellence.

Center for Public Safety Excellence. (2009). *CFAI Fire & emergency service self-assessment manual, 8th Edition.* Chantilly, VA: Center for Public Safety Excellence.

Church, R., Sorenson, P., & Corrigan, W. (2001). Manpower deployment in emergency services. *Fire Technology 37 (3)* , 219-234.

Fitch, J. J., Ragone, M. G., & Griffiths, K. (2010). Making smart choices about fire and emergency medical services in a difficult economy. *InFocus Strategies and Solutions for Local Government Managers 42(5)* , 1-21.

Heifetz, R. A., & Linsky, M. (2002). *Leadership on the line, staying alive through the dangers of leading.* Boston, MA: Harvard Business Review Press.

Ignall, E. J., Kolesar, P., Swersey, A. J., Walker, W. E., Blum, E. H., Carter, G., et al. (1975). Improving the deployment of New York City fire companies. *Interfaces 5(2-Part2)* , 48-61. http://dx.doi.org/10.1287/inte.52pt2.48.

Kolesar, P., & Walker, W. E. (1974). An algorithm for the dynamic relocation of fire companies. *Operations Research 22(2)* , 249-274. http//dx.doi.org/10.1287/opre.22.2.249.

MacCharles, L. (2008). *NFPA 1710: Can Calgary Fire make it work?* Emmitsburg, MD: National Fire Academy.

Maxwell, M. S., Restrepo, M., Henderson, S. G., & Topaloglu, H. (2010). Approximate dynamic programming for ambulance redeployment. *INFORMS Journal on Computing 22(2)* , 266-281. http://dx.doi.org/10.1287/ijoc.1090.0345.

National Fire Protection Association. (2009). *NFPA 1710 Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments 2010 Edition.* Quincy, MA: National Fire Protection Association.

Peace, D. M. (2001). Planning new standards of fire service emergency cover for the United Kingdom. *Fire Technology 37 (3)* , 279-290.

TriData. (1996). *Vancouver Fire and Rescue Service Deployment Study.* Arlington, VA: TriData Corporation.

United States Fire Administration. (2012). *Executive Development (Student Manual 4th Edition, 3rd Printing).* Emmitsburg, MD: United States Fire Administration.

United States Fire Administration. (2013). *Executive Development Applied Research Course Guide*. Emmitsburg, MD: United States Fire Administration.

United States Fire Administration. (2013). *Executive Fire Officer Program Applied Research Guidelines.* Emmitsburg, MD: United States Fire Administration.

Washko, J. D. (2012). Rethinking delivery models: EMS industry may shift deployment methods. *JEMS 37(7)* , 32-36.

Appendix A

2014 Dynamic Deployment Model Survey Script

Page #1
Simple Skipping Information
• If Since December 2014, have you utilized the Dynamic... = Yes then Skip to Page 2
• If Since December 2014, have you utilized the Dynamic... = No then Skip to Page 14

The Calgary Fire Department's Operations Division and Strategic Services team developed a Dynamic Deployment model to improve station performance in response to busyness issues. The model provides a set of priorities and considerations to assist in decision-making when conducting day-to-day station backfilling. The purpose of the deployment model is to improve the CFD's ability to maintain optimal response coverage and service levels across the city during busy and peak times, when training and apparatus maintenance requirements arise, and during large-scale incidents.

In order to evaluate the Dynamic Deployment model pilot, CFD is requesting your input by completing this survey. We appreciate your participation and will take into consideration any feedback and suggestions you have. Please note that all submissions are anonymous and results will be aggregated to ensure confidentiality. The survey will take approximately 10 minutes. Please submit your completed survey by November 10th. Thank you for your time and participation.
For more information please navigate to:
http://cfdnet/Library/prog_proj/PIP/PIPDeployment/Pages/DynamicDeploymentModel.aspx

Are you a:
Member of Fire Executive Team
Chief Officer
Qualified Chief Officer
Other, please specify... ___________________________

Based on your experience, on a 1-10 scale, how would you rate the overall implementation of the Dynamic Deployment Model?
(1 being "Not at All Satisfied" and 10 being "Very Satisfied")
1 – Not at All Satisfied
2
3
4
5 – Neither Satisfied Nor Dissatisfied
6
7
8
9
10 – Very Satisfied

Not Applicable

And why did you say you were satisfied or dissatisfied with the implementation of the Dynamic Deployment Model?

Since December 2014, have you utilized the Dynamic Deployment model?
Yes
No

Page #2

Simple Skipping Information
• If Based on your experience, on a 1-10 scale, how eas... = 6 then Skip to Page 4
• If Based on your experience, on a 1-10 scale, how eas... = 7 then Skip to Page 4
• If Based on your experience, on a 1-10 scale, how eas... = 8 then Skip to Page 4
• If Based on your experience, on a 1-10 scale, how eas... = 9 then Skip to Page 4
• If Based on your experience, on a 1-10 scale, how eas... = 10 – Very Easy then Skip to Page 4
• If Based on your experience, on a 1-10 scale, how eas... = Not Applicable then Skip to Page 4

Approximately how often do you use the Dynamic Deployment Model?
Every Shift (Once a day)
Once a Tour (Once every four days)
Every 2 Tours (Once in two weeks)
Once a Month
Once every two months
Once every 3- 4 months
Once every 5- 6 months
Other ___________________________
Never

Based on your experience, on a 1-10 scale, how easy was it for you to use the Dynamic Deployment Model on a day-to-day
basis?
(1 being “Not Easy at All” and 10 being “Very Easy”)
1 – Not at All Easy
2
3
4
5 – Neither Easy Nor Very Easy
6
7
8
9
10 – Very Easy
Not Applicable

Page #3

And why did you say that using the Dynamic Deployment Model on a day-to-day basis was not easy?

Page #4

Simple Skipping Information
• If Based on your experience, on a 1-10 scale, how eas... = 6 then Skip to Page 6
• If Based on your experience, on a 1-10 scale, how eas... = 7 then Skip to Page 6
• If Based on your experience, on a 1-10 scale, how eas... = 8 then Skip to Page 6
• If Based on your experience, on a 1-10 scale, how eas... = 9 then Skip to Page 6
• If Based on your experience, on a 1-10 scale, how eas... = 10 – Very Easy then Skip to Page 6
• If Based on your experience, on a 1-10 scale, how eas... = Not Applicable then Skip to Page 6

Based on your experience, on a 1-10 scale, how easy was it for you to use the Dynamic Deployment Model in a large-scale
emergency (such as the September snowfall event)?
(1 being “Not Easy at All” and 10 being “Very Easy”)
1 – Not at All Easy
2
3
4
5 – Neither Easy Nor Very Easy
6
7
8
9
10 – Very Easy
Not Applicable
Page #5

And why did you say that using the Dynamic Deployment Model in a large-scale emergency was not easy?

Page #6

Simple Skipping Information
• If Based on your experience, on a 1-10 scale, how eas... = 6 then Skip to Page 8
• If Based on your experience, on a 1-10 scale, how eas... = 7 then Skip to Page 8
• If Based on your experience, on a 1-10 scale, how eas... = 8 then Skip to Page 8
• If Based on your experience, on a 1-10 scale, how eas... = 9 then Skip to Page 8
• If Based on your experience, on a 1-10 scale, how eas... = 10 – Very Easy then Skip to Page 8
• If Based on your experience, on a 1-10 scale, how eas... = Not Applicable then Skip to Page 8

Based on your experience, on a 1-10 scale, how easy was it for you to use the Apparatus Redeployment Table?
http://cfdnet/Library/prog_proj/PIP/PIPDeployment/Documents/CFD%20Apparatus%20Redeployment%20Table%20and%20Guidelines.pdf
(1 being "Not Easy at All" and 10 being "Very Easy")
1 – Not at All Easy
2
3
4
5 – Neither Easy Nor Very Easy
6
7
8
9
10 – Very Easy
Not Applicable
Page #7

And why did you say that using the Apparatus Redeployment Table was not easy?

Page #8

Simple Skipping Information
• If Are you following the guidelines identified by the... = Yes then Skip to Page 10
• If Are you following the guidelines identified by the... = No then Skip to Page 9

Are you following the guidelines identified by the Dynamic Deployment model including the second engine rules?
Yes
No

Page #9

Why did you say you were not following the Dynamic Deployment guidelines?

Page #10

Simple Skipping Information
• If Based on your experience, on a 1-10 scale, when th... = 6 then Skip to Page 12
• If Based on your experience, on a 1-10 scale, when th... = 7 then Skip to Page 12
• If Based on your experience, on a 1-10 scale, when th... = 8 then Skip to Page 12
• If Based on your experience, on a 1-10 scale, when th... = 9 then Skip to Page 12
• If Based on your experience, on a 1-10 scale, when th... = 10 – Very Positive then Skip to Page 12

Based on your experience, on a 1-10 scale, when the Dynamic Deployment model was used for apparatus movement, what was the feedback given by Captains and crew members?
(1 being "Not at all Positive" and 10 being "Very Positive")
1 – Not at All Positive
2
3
4
5 – Neutral
6
7
8
9
10 – Very Positive

Page #11

Why did you say that the implementation of the Dynamic Deployment model was not well received?

Page #12

What are three things you think the Dynamic Deployment Model has succeeded at?

What are three things you think could improve the Dynamic Deployment Model?

Page #13

Would automating the process for day-to-day apparatus moves help you consistently apply the Apparatus Redeployment Guidelines?
Yes
No

And why do you say that?

Page #14

Do you have any other comments about the Dynamic Deployment model or suggestions for improvement?

This completes the Dynamic Deployment model questionnaire. Thank you for your time and participation.

Appendix B

Introduction Email Sent to Survey Participants

From: [redacted]
Sent: Tuesday, November 04, 2014 4:12 PM
To:
Cc:
Subject: 2014 Dynamic Deployment Model Assessment

Good Afternoon:

As you may know, the Calgary Fire Department's Operations Division and Strategic Services team developed a Dynamic Deployment model to improve station performance in response to busyness issues. Launched in December of 2013, the model provides a set of priorities and considerations to assist in decision-making when conducting day-to-day station backfilling.

The purpose of the deployment model is to improve the CFD's ability to maintain optimal response coverage and service levels across the city during busy and peak times, when training and apparatus maintenance requirements arise, and during large-scale incidents. In order to evaluate the Dynamic Deployment model pilot, CFD is requesting your input by completing an online survey. We appreciate your participation and will take into consideration any feedback and suggestions you have. Please click on the link below to access the survey:

http://fluidsurveys.com/surveys/cfd-calgary/2014-dynamic-deployment-model-assessment/

Please note that all submissions are anonymous and results will be aggregated to ensure confidentiality. The survey will take approximately 10 minutes to complete. Please submit your completed survey by **November 10th.**

Thank you for your time and participation and please let me know if you have any questions.
Thanks,
[redacted]
Supervisor, Research & Accreditation
Strategic Services Division
Calgary Fire Department | The City of Calgary
5727 23 Avenue SE T2B 3E2
Mail Code 50
Tel: [redacted] || www.calgaryfire.ca

Internationally Accredited by:
Commission on Fire Accreditation International

Appendix C

Follow Up Email Sent to Survey Participants

From: [redacted]
Sent: Thursday, November 13, 2014 9:04 AM
To:
Cc:
Subject: Dynamic deployment Survey
Importance: High

Good Morning:

For those of you who have not had a chance to respond to the Dynamic Deployment survey, I'm hoping that you can provide your feedback as soon as possible. We're looking to incorporate the survey findings into the review of the Dynamic Deployment Model, so your input is very important.

As a reminder, the survey can be accessed through the link attached: http://fluidsurveys.com/surveys/cfd-calgary/2014-dynamic-deployment-model-assessment/
If you have had trouble accessing the survey, please let Erin Corrigan know.

Thank you for your time,

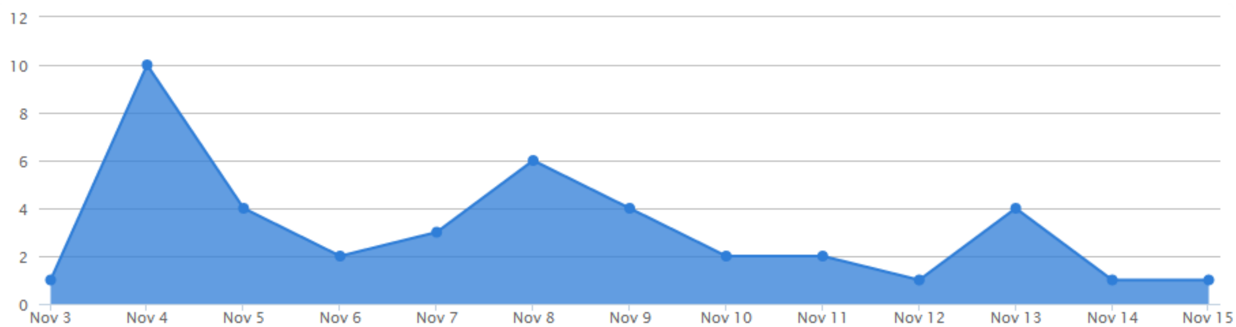
[redacted], BAppB:ES, CFO, SCO
Fire Chief
Calgary Fire Department
T) [redacted], F) [redacted]
Mailcode #0049
FireChiefCalgary@calgary.ca
PRIDE   PROFESSIONALISM   RESPECT   TEAMWORK
ISC: PROTECTED

Appendix D

Survey Response Summary

Response Summary Stats

Survey in field from November 3rd – November 18th



TOTAL RESPONSES	COMPLETED RESPONSES	COMPLETION RATE	COMPLETION TIME
41	32	78%	35:47

1. Are you a:

Response	Chart	Percentage	Count
Member of Fire Executive Team		17.1%	7
Chief Officer		58.5%	24
Qualified Chief Officer		24.4%	10
Other, please specify...		0.0%	0
		Total Responses	**41**

2. Based on your experience, on a 1-10 scale, how would you rate the overall implementation of the Dynamic Deployment Model? (1 being "Not at All Satisfied" and 10 being "Very Satisfied")

Response	Chart	Percentage	Count
1 - Not at All Satisfied		2.4%	1
2		4.9%	2
3		2.4%	1
4		2.4%	1
5 - Neither Satisfied Nor Dissatisfied		7.3%	3
6		9.8%	4
7		19.5%	8
8		26.8%	11
9		19.5%	8
10 - Very Satisfied		4.9%	2
Not Applicable		0.0%	0
		Total Responses	**41**

3. And why did you say you were satisfied or dissatisfied with the implementation of the Dynamic Deployment Model?

The 36 response(s) to this question can be found in the appendix on Page 12.

Response	Chart	Percentages	Count
Better coverage to minimize risk		22%	8
Satisfied		22%	8
Allows more flexibility for training, events, etc		16%	6
Need to be able to use second engines (Station 10 & Station 30 as alphas)		13%	5
Better Resource Utilization		8%	3
Moving more rigs than necessary		5%	2
Other		30%	11

4. Since December 2014, have you utilized the Dynamic Deployment model?

Response	Chart	Percentage	Count
Yes		85.4%	35
No		14.6%	6
		Total Responses	**41**

5. Approximately how often do you use the Dynamic Deployment Model?

Response	Chart	Percentage	Count
Every Shift (Once a day)		58.8%	20
Once a Tour (Once every four days)		14.7%	5
Every 2 Tours (Once in two weeks)		2.9%	1
Once a Month		11.8%	4
Once every two months		0.0%	0
Once every 3- 4 months		0.0%	0
Once every 5- 6 months		0.0%	0
Other		11.8%	4
Never		0.0%	0
		Total Responses	**34**

Approximately how often do you use the Dynamic Deployment Model? (Other)

#	Response
1.	In executive, so not using on a day to day basis
2.	Batt/district Chiefs primarily utilize tool
3.	I have only acted DC occasionally so i have only used it a couple of times.

6. Based on your experience, on a 1-10 scale, how easy was it for you to use the Dynamic Deployment Model on a day-to-day basis? (1 being "Not Easy at All" and 10 being "Very Easy")

Response	Chart	Percentage	Count
1 - Not at All Easy		0.0%	0
2		0.0%	0
3		5.9%	2
4		2.9%	1
5 - Neither Easy Nor Very Easy		5.9%	2
6		5.9%	2
7		14.7%	5
8		35.3%	12
9		20.6%	7
10 - Very Easy		8.8%	3
Not Applicable		0.0%	0
		Total Responses	**34**

7. And why did you say that using the Dynamic Deployment Model on a day-to-day basis was not easy?

#	Response
1.	Unless you have an Imobile in front of you to see coverage in the City it is difficult to not leave gaps in the City.
2.	It would be far easier to send an Engine from 10 ,12 ,30 ,22. than cascading rigs for coverage. It also would give our customers better fire protection.
3.	Emotionally the moves are difficult due the fact that I am consciously supporting a model that I totally disagree with. As for making the moves its difficult due to the fact that our compliment of supporting apparatus is inadequate
4.	It was a big change to the way we were normally providing coverage and changes always take time to adjust to.
5.	Using part time ADC in dispatch only serves to confuse and complicate the deployment. The rules regarding the two engine stations is not required and only makes the efficient coverage of the City with engines more difficult

8. Based on your experience, on a 1-10 scale, how easy was it for you to use the Dynamic Deployment Model in a large-scale emergency (such as the September snowfall event)? (1 being "Not Easy at All" and 10 being "Very Easy")

Response	Chart	Percentage	Count
1 - Not at All Easy		2.9%	1
2		8.8%	3
3		2.9%	1
4		2.9%	1
5 - Neither Easy Nor Very Easy		14.7%	5
6		8.8%	3
7		11.8%	4
8		11.8%	4
9		8.8%	3
10 - Very Easy		8.8%	3
Not Applicable		17.6%	6
		Total Responses	**34**

9. And why did you say that using the Dynamic Deployment Model in a large-scale emergency was not easy?

#	Response
1.	Doing the job justice demands a certain amount of information. Rig location, future incident demands, prior training commitments and other factors all impact the decisions made. Gathering all this information in one location is difficult. Perhaps once the Firehub is up and running, the accessibility of the required data will be more convenient.
2.	To use your example of the "Snowtember" event, there was absolutely NO deployment model, or systematic approach used during the peak period. Rather, the innumerable flags which populated the CAD display resulted in single apparatus self dispatching to these events. In other words, apparatus Officers would advise dispatch which call they were taking next, simply by looking on CAD and picking the next closest red flag on the screen. There did not appear to be a planned, proactive approach (Deployment Model), but rather reactive, tail-wagging the dog type activity. As per CFD Net: "the purpose of the deployment model is to improve the CFD's ability to maintain optimal response coverage and service levels across the city during busy and peak times, ... and during large-scale incidents. Snowtember was a large scale incident, and it seemed like we were not able to measure, control, or be aware of how apparatus were being over utilized, or underutilized.

3.	HAVEN'T USED IT YET IN A LARGE SCALE EMERGENCY
4.	HAVEN'T DONE IT ON A LARGE SCALE EMERGENCY YET
5.	On a large scale we do what we have to do and set protocols are not as measured. We make sure we spread our coverage out as best we can.
6.	Same as previous answer
7.	The number of incidents and the required apparatus for those incidents can out strip our ability to provide any coverage.
8.	Many things to consider when deploying apparatus through out the city, and with a large scale event everything and everyone are almost involved already. Usually there is a strong need for additional Engines this is almost always the case.
9.	tracking of units and their back log of calls, call type, potential duration of each call, the large number of unknown variables for each incident decreases predictability.
10.	Rules regarding the critical engines makes no sense during a large scale event. Many rigs and crews have just sat and done nothing while other crews are over taxed for the entire event.
11.	Hard to move rigs and not have too many auxiliary rigs in one quadrant I always try to have Engines in an adjoining district with an auxiliary

10. Based on your experience, on a 1-10 scale, how easy was it for you to use the Apparatus Redeployment Table? (1 being "Not Easy at All" and 10 being "Very Easy")

Response	Chart	Percentage	Count
1 - Not at All Easy		0.0%	0
2		0.0%	0
3		0.0%	0
4		6.2%	2
5 - Neither Easy Nor Very Easy		12.5%	4
6		15.6%	5
7		21.9%	7
8		28.1%	9
9		9.4%	3
10 - Very Easy		6.2%	2
Not Applicable		0.0%	0
		Total Responses	**32**

11. And why did you say that using the Apparatus Redeployment Table was not easy?

#	Response
1.	The apparatus suggested were not available so you had to improvise, which is fine. I very rarely use the table. A way to know / see where rigs are from a computer in the station would be helpful.
2.	I USE THE TABLE AS A GUIDELINE, MORE THAN A RULE
3.	On a large scale event the specialty halls are used like all others.
4.	Its out dated and doesn't read well
5.	The statistics used to the develop the table were not current. With the opening of new Stations the guidelines were dated and restricted the movement of certain apparatus.

12. Are you following the guidelines identified by the Dynamic Deployment model including the second engine rules?

Response	Chart	Percentage	Count
Yes		71.9%	23
No		28.1%	9
		Total Responses	**32**

13. Why did you say you were not following the Dynamic Deployment guidelines?

#	Response
1.	Typically, I follow deployment guidelines, however, at times I will redeploy Engine 47 In the south part of the city. Eng 47 is an better choice to move to many other stations to provide coverage (engine and 4 ff's rather than a truck and 2 ff's), rather than move a secondary rig, or make 2 moves to cover a critical station (ie: Stn 14). If, while Eng 47 is redeployed, Stn 30 requires coverage, Eng 47 can be moved back to Stn 30 and other moves can be made to backfill the void created. During busy times, moving Eng 47 also assists in preventing 2 adjacent stations from being staffed by secondary rigs at the same time.
2.	Second engines at #30 and #10 should be used. The other two engine halls I understand.
3.	I have used the second engine from #10 and #30 to provide coverage. Other than that I have followed the rules. It seemed smart when covering a heavy rescue drill....both #9and #25 are empty for the drill. filling those halls with support apparatus and leaving engine 39 and 2 engines at 30 and a engine at 41 didn't seem as smart and taking one from 30 and putting it at #9 or #25
4.	Engine 47 and 48 do not get the call volume that E27, E46 get and I believe our citizens in the out side districts deserve proper fire protection. Management needs to acknowledge this and make the changes, do not worry about keeping them all the same because they are not all the same.
5.	There are times when its not feasible or due able because of outstanding circumstances
6.	I follow the guidelines for the most part but will use units as it is most practical for the situation.
7.	The data used to develop the second engine guidelines for Station 30 was outdated and did not take into account that two new stationed opened by the time the model was implemented.
8.	At this time we have the ability to utilize 47 and 48 as they in a stage of transition as for the others they will be utilized last as there becomes a time when there is a need to have engines balanced throughout the city for proper coverage as not to leave big gaps/holes where there are no engines available for districts.
9.	At times when things were busy and options limited I have used E48 and E47.

14. Based on your experience, on a 1-10 scale, when the Dynamic Deployment model was used for apparatus movement, what was the feedback given by Captains and crew members? (1 being "Not at all Positive" and 10 being "Very Positive")

Response	Chart	Percentage	Count
1 - Not at All Positive		12.5%	4
2		3.1%	1
3		0.0%	0
4		6.2%	2
5 - Neutral		28.1%	9
6		9.4%	3
7		28.1%	9
8		9.4%	3
9		3.1%	1
10 - Very Positive		0.0%	0
		Total Responses	**32**

15. Why did you say that the implementation of the Dynamic Deployment model was not well received?

#	Response
1.	some of feedback from non-chief officers was negative. I believe this was because of a lack of knowledge of the program.
2.	I have not received any feedback which is why I put in a rating of 5
3.	Certain moves where the logic was apparent were very well received. There was little or no hesitation when the move made sense. Pushback came when there were moves made that didn't appear logical on the surface.
4.	I did not say that. I said it was neutral. I did not get positive, nor negative feedback.
5.	Captains dislike leaving there own districts open.
6.	I didn't say that. I said 'neutral'
7.	IN THINK OFFICERS ARE WONDERING WHY SO MANY RIGS ARE MOVING AND WHY SOME STATIONS ARE LEFT WITHOUT AN ENGINE SO ANOTHER DISTRICT HAS ONE

8.	These are the men and women on the street using this and we can all see that a 2 person crew with out the proper equipment can not do the same amount of work that a proper 4 person Engine can do.
9.	Example) Put 1 junior medic in a car with no medical equipment to respond to calls Stress, unable to do job, feeling of not achieving, frustration
10.	The idea of possibly leaving Stations open when they are low on the priority list
11.	Captains in all the halls don't agree with moving in secondary apparatus into the halls and the Lt's are petrified about having to make calls with no water being 1st on scene.
12.	Very mixed feedback. Good and bad.
13.	It placed some of our more junior acting officers on auxiliary apparatus at an incident with out enough resources or experience. It removed crews from their stations and districts, reducing the amount of time available to complete hydrant and building inspections / orientation of buildings in the district.
14.	Lack of understanding of the concept due to poor explanations to those affected most.
15.	Many fire crews felt that an Engine was required to cover each station at all time. Some officers felt it was poor customer service and misleading to have a two man unit in a station instead of an engine.

16. What are three things you think the Dynamic Deployment Model has succeeded at?

The 27 response(s) to this question can be found in the appendix on page 15.

Response	Chart	Percentages	Count
Increasing community coverage		62%	17
Gives junior officers a chance to better utilize skills		44%	12
Basic/ Consistent guidelines (easy-to-follow)		29%	8
Faster response		29%	8
Better utilization of resources		22%	6
Easier to schedule training		18%	5
Other		11%	3

17. What are three things you think could improve the Dynamic Deployment Model?

The 25 response(s) to this question can be found in the appendix on page 17.

Response	Chart	Percentages	Count
Allow more flexible use of second engines (squad model)		44%	11
Formalized/automated system to move units		36%	9
Staff auxiliary rigs with additional manpower		16%	4
Increased education/ communication about the model		12%	3
Other		64%	16

18. Would automating the process for day-to-day apparatus moves help you consistently apply the Apparatus Redeployment Guidelines?

Response	Chart	Percentage	Count
Yes		31.0%	9
No		69.0%	20
		Total Responses	**29**

19. And why do you say that?

The 27 response(s) to this question can be found in the appendix on page 19.

Response	Chart	Percentages	Count
Too many variables for automated model		44%	12
Automating would allow guidelines would be consistently applied		25%	7
Not automating would allow system to be dynamic		22%	6
Automating model would decrease work load		7%	2
Other		3%	1

20. Do you have any other comments about the Dynamic Deployment model or suggestions for improvement?

The 20 response(s) to this question can be found in the appendix on page 21.

Appendix

3. And why did you say you were satisfied or dissatisfied with the implementation of the Dynamic Deployment Model? |

#	Response
1.	BEING ABLE TO COVER STATIONS WITH SECONDARY APPARATUS MAKES IT EASIER TO FACILITATE TRAINING AND OTHER EVENTS THAN IT WAS WHEN WE COULD ONLY USE THE COVERING ENGINES.
2.	Has provided clear guide that promotes consistency through the platoons.
3.	I feel the model allows for better utilization of the resources during busy periods and during large incidents.
4.	Optimal coverage for all districts in the city
5.	Role out could have been a little better planned with detailed information provided to fire crews prior to launch
6.	Typical deployment of new programs in the CFD
7.	[Allows more flexibility for training, events, etc]Because it allows the Chief officer great flexibility for training, public events and during large scale incidents.
8.	[Allows more flexibility for training, events, etc]It allows for greater flexibility when it comes to Training
9.	[Allows more flexibility for training, events, etc]The new model does allow more flexibility to allow training, backfilling take place.
10.	[Allows more flexibility for training, events, etc][Better coverage to minimize risk]The implementation of the Dynamic deployment model has enabled additional training maintained ERF performance, maintained accreditation.
11.	[Allows more flexibility for training, events, etc][Other]This question is not simple to answer. It depends on priorities. The system makes completing daily training and other activities much easier than our old practices. However we are dependent on much less experienced personnel and under equipped units like Rescues to cover and Command what used to be the responsibility of an Engine. This does leave those communities and crews a little more vulnerable.
12.	[Better Resource Utilization]Have seen an increase in reliability and minimal empty stations as a result
13.	[Better Resource Utilization][Allows more flexibility for training, events, etc][Better coverage to minimize risk] allows for current optimal state of risk mitigation in relation to distribution of resources, and the ability to provide a positive first intervention. Have already seen the benefits

	in relation to providing coverage for training, emergency response, and allowing for various resource types to respond to medical emergencies.
14.	[Better Resource Utilization][Other] satisfied in that the model creates better resource utilization to serve the public. I believe better initial member education could have minimized some of the initial member push-back.
15.	[Better coverage to minimize risk]Consistent coverage model
16.	[Better coverage to minimize risk]Meets deployment model by assessing risk and aids to provide a fire response from within district as opposed to outside.
17.	[Better coverage to minimize risk]Meets our deployment model by assessing risks and helping to ensure no stations are left empty.
18.	[Better coverage to minimize risk]To have appropriate coverage for a district when the home Eng is away
19.	[Better coverage to minimize risk]We now provide coverage of some kind to districts that would not necessarily have been covered in the past
20.	[Moving more rigs than necessary]I THINK WE ARE MOVING MORE APPARATUS THAN IS NEEDED. I ALSO THINK WE ARE SHORTENING THE LIFE CYCLE OF SUCH VEHICLES
21.	[Moving more rigs than necessary]I THINK WE ARE MOVING MORE RIGS THAN NECESSARY TO FILL FIRE STATIONS. I ALSO THINK WE ARE SHORTENING OUR LIFE CYCLES BY DOING THIS.
22.	[Need to be able to use second engines (Station 10 & Station 30 as alphas)][Better coverage to minimize risk]Using secondary apparatus as Primary in stations I believe works well to get apparatus on scene sooner. As far as moving Engines from there own District to another compromises there response into there own district as most of the time we cannot tell where a fire is going to happen. I do believe using a second Engine (Alpha) for coverage is acceptable. Most stations responding from there own station into another District are not usually that much further behind time wise.
23.	[Need to be able to use second engines (Station 10 & Station 30 as alphas)][Other]It's limited and has to be monitored very closely to have the proper coverage throughout the city, these dynamics are also constantly changing when you consider in call volumes, time of day and weather conditions. At times it is very hard to balance out and have Engines within the proper response areas.
24.	[Need to be able to use second engines (Station 10 & Station 30 as alphas)][Other]No input was requested from the people using the system. (US) .. Also there should not be districts being covered by secondary apparatus when we have engines in stations like 10 and 30. Eg 38 station being covered by 32 Rescue.

25.	[Other]Is part of the purpose of the new deployment model to satisfy employees? Why are we asking about our satisfaction? Our "satisfaction" is quite irrelevant, however perhaps we are asking about our impression of the effectiveness of the implementation of the deployment model, or perhaps it is our impression of the effectiveness of the model itself. If the latter is true, then we need to be given the criteria on which we are rating the model's effectiveness. Otherwise, all we get is irrelevant "data" that x % of us are "satisfied" (about something that is quite unclear).
26.	[Other]Some of the guidelines make sense and other do not.
27.	[Other]The covering of stations should always be with a fully staffed (minimum 4) and equipped Fire Engine. The CFD goal of firefighter and public safety with property conservation is not achievable with the current dynamic deployment model. All the risk is but on the backs of the firefighters and to the (unaware) Calgary citizens. The minimum staffing levels outlined in the NFPA 1710 document (supported by the IAFC and IAFF) also disagrees with our model. Hopefully with a new Chief these actions will be reversed
28.	[Other]Tough to move a secondary apparatus into a hall and worried about having a fire in the district with a rescue now the rig has no water on scene and has to make the call on the rescue. Our SOP's say don't go in with no water but now this is something the officer and driver have to deal with go in or not?
29.	[Satisfied]Concept has merit
30.	[Satisfied]It helps explain why things are done regarding moves.
31.	[Satisfied]Progressive way to improve service
32.	[Satisfied]Works very well, most of the time.
33.	[Satisfied][Need to be able to use second engines (Station 10 & Station 30 as alphas)]It good to be able to recognize a stations priority according to the deployment model to ensure the critical areas are covered. Even though I do not agree with leaving 12 and 22stn. with 2 engines in each hall and 23stn also critical, when engines are required in the remainder of the city.
34.	[Satisfied][Need to be able to use second engines (Station 10 & Station 30 as alphas)][Other]Although the concept is excellent, the execution of the concept may have flaws. Our inability to use engines from multiple engine stations because they are deemed critical stations (In particular E47 and 48) reduces the effectiveness of the process. While it's understood that redeploying these apparatus to outlying stations with lower calls volumes is not optimal, they should be available for redeployment to other stations with substantial call volumes that aren't on the critical station list. (IE: stations 8, 18, 7, 5, 19, etc.) By making it a hard rule that they cannot be used and not leaving it to the discretion of the District Chiefs with a few guidelines, some efficiencies were lost. The examples given on the tables and guidelines sheet led to further confusion. (IE: Point 4 station 7 is booked down; E18 covers 7 and E38 covers 18. What covers 38 and could A/L7 not cover the station and prevent the movement of two engines? 7 Station is literally surrounded by 7 other engines that are within a very short response time. 38 station is not.) I feel that perhaps the conclusions perceived from data contained on the chart were in err. If

	the prime consideration is to get CFD personnel on scene quickly, the current model is not as effective as it could be.
35.	[Satisfied][Other]The idea is good. A rig should respond to an incident because it is close and not because of the type. I mean send the aerial if it is in the hall and don't wait for and engine. I'm not completely satisfied because I still struggle when providing coverage.
36.	[Satisfied][Other]Two part answer. 1)Having an auxiliary rig (Rescue, Aerial, etc.) as primary when the engine is dispatched to another call is absolutely correct.2)Covering stations for a longer duration (ie: training or an large incident) with auxiliary apparatus being staffed with 2 people while there are still stations with 2 engines in them still doesn't seem like the logical approach. I understand that auxiliary rigs may be first in on any given day, however, having them arrive on such a common intentional basis reminds me of how a volunteer department might operate. If these rigs were staffed with 4 personnel or at least a minimum of 3 I would have no problem with the current model.

16. What are three things you think the Dynamic Deployment Model has succeeded at? |

#	Response
1.	[Basic/ Consistent guidelines (easy-to-follow)]A BASIC GUIDELINE
2.	[Basic/ Consistent guidelines (easy-to-follow)]Making it clear what moves can be made Suggested moves Engs. or halls that cant be moved
3.	[Basic/ Consistent guidelines (easy-to-follow)]providing consistency, specific guidelines, greater efficiency to make decisions
4.	[Basic/ Consistent guidelines (easy-to-follow)][Easier to schedule training]Moving for training / laying out expectations
5.	[Better utilization of resources]Increased efficiency of resources to cover areas during large incidents.
6.	[Better utilization of resources]makes moves easier shares the work load fairly provides the coverage for the city
7.	[Better utilization of resources][Faster response]Using secondary apparatus for medical and getting apparatus on scene faster.
8.	[Faster response][Other][Easier to schedule training]Created additional Training, Maintained ERF, Maintained Accreditation
9.	[Gives junior officers a chance to better utilize skills][Faster response]Getting firefighters on scene faster. Making firefighters aware that they can be helpful at a scene even if they are not on an engine.
10.	[Increasing community coverage]creating better community coverage

11.	[Increasing community coverage][Basic/ Consistent guidelines (easy-to-follow)]District Coverage, Useable flow charts
12.	[Increasing community coverage][Basic/ Consistent guidelines (easy-to-follow)]Easier to cover halls, less domino effect of moving a rig or when a station requires coverage, less domino effect means happier crews which means better morale.
13.	[Increasing community coverage][Better utilization of resources] 1. Provides a higher level of coverage for the City than ever before.2. It creates a flexible net to cover the city that is very quick to deploy.
14.	[Increasing community coverage][Better utilization of resources][Basic/ Consistent guidelines (easy-to-follow)]maximization of resources provide increased and enhanced coverage consistent approach / guidelines to how resources are deployed
15.	[Increasing community coverage][Better utilization of resources][Gives junior officers a chance to better utilize skills]It has allowed the Auxiliary rigs to be better utilized. It has given some of the Junior officers a chance to use there IC skills more regularly It has allowed the CFD not to leave districts vulnerable.
16.	[Increasing community coverage][Faster response][Other][Easier to schedule training]-improved response time (on paper)-the illusion of a properly staffed firehall-capability to have more training at 1 time
17.	[Increasing community coverage][Gives junior officers a chance to better utilize skills] 1-Ensuring all districts are covered by a rig.2-Allowing firefighters in "quiet" Stns to become more engaged.
18.	[Increasing community coverage][Gives junior officers a chance to better utilize skills]Coverage within the community's, Better awareness and engagement for junior officers,
19.	[Increasing community coverage][Gives junior officers a chance to better utilize skills]providing in district coverage risk based deployment more experience for Lt.
20.	[Increasing community coverage][Gives junior officers a chance to better utilize skills][Basic/ Consistent guidelines (easy-to-follow)]1. Providing an opportunity for junior officers, and for other officers who are not at busy stations to enhance their skills.2. Providing an opportunity for ALL platoons to do something consistent across all 4 platoons!3. Raising awareness about CFD's risk management approach to producing data: CFD uses call volume, severity of historical incidents, probable timing of incidents, response reliability, historic response times, technical teams placement, district-specific risks, hazards and demands
21.	[Increasing community coverage][Gives junior officers a chance to better utilize skills][Easier to schedule training]1. EASIER TO SCHEDULE APPARATUS MOVES FOR TRAINING (I.E. EVALUATIONS, IMS) 2. IN THE PAST TRAINING WAS OFTEN THE FIRST THING CANCELLED WHEN WE HAD TOO MANY CALLS GOING ON AND ONLY HAD COVERING ENGINES TO USE.3. HAVING A PRIMARY RESPONSE UNIT OF SOME TYPE IN A DISTRICT MORE OFTEN (STATIONS/DISTRICTS EMPTY LESS OFTEN).4. I

	BELIEVE MANY LT. & A/LT. HAVE "PICKED UP THEIR GAME" KNOWING THE CHANCE OF THEM BEING FIRST ONSCENE HAS INCREASED.
22.	[Increasing community coverage][Gives junior officers a chance to better utilize skills][Easier to schedule training]Easier to schedule training. Complete city coverage most of the time. Raises the level of the Lt. performance.
23.	[Increasing community coverage][Gives junior officers a chance to better utilize skills][Faster response] 1) Better/quicker coverage by auxiliary apparatus when the engine is dispatched to a call out of the same hall.2) Lieut's experience in arriving at calls first will make their transition to the Captains position much easier.3) Auxiliary rig personnel become more familiar with different districts by covering various stations.
24.	[Increasing community coverage][Gives junior officers a chance to better utilize skills][Faster response]Getting an apparatus on scene in the designated time frames. Keeping some type of apparatus coverage in most Stations / districts. Forced the junior officer to ensure they were prepared.
25.	[Increasing community coverage][Gives junior officers a chance to better utilize skills][Faster response]Getting trucks to calls quicker Keeping stations staffed more often providing more IC opportunities to LTs
26.	[Increasing community coverage][Gives junior officers a chance to better utilize skills][Faster response]Improved district coverage Improved officer awareness of first due responsibilities. Improved awareness of arrival times being very important.
27.	[Other]I do not believe that this model has succeeded in doing any thing.

17. What are three things you think could improve the Dynamic Deployment Model? |

#	Response
1.	[Allow more flexible use of second engines (squad model)]An engine that is used to back fill halls.
2.	[Allow more flexible use of second engines (squad model)]Do not be so hard core on not using the second engines in some halls. I spent 16 years at # 12 station and I can only think of once that both engine went to calls of any size at the same time.
3.	[Allow more flexible use of second engines (squad model)]Go back to the Squad model of a 4 f/f engine covering firehalls
4.	[Allow more flexible use of second engines (squad model)]The ability to use the second Eng during evening and week ends.
5.	[Allow more flexible use of second engines (squad model)][Formalized/automated system for Dispatch to move units]1. HAVING MPS UNITS IN DISTRICT CHIEF OFFICES TO ENABLE US TO TRACK AND MOVE APPARATUS WITHOUT HAVING TO GO BACK AND FORTH TO OUR VANS. 2. MORE AUTOMATED/AUTOMATIC SYSTEM OF

	RECOGNIZING WHICH RIG IS PRIMARY. (I.E. WHEN E31 GOES OUT ON A CALL AND R31 IS IN STATION R31 SHOULD AUTOMATICALLY BE PRIMARY).3. BEING ABLE TO USE THE SECOND ENGINE AT "CRITICAL" STATIONS FOR COVERAGE WHEN NECESSARY.
6.	[Allow more flexible use of second engines (squad model)][Formalized/automated system for Dispatch to move units]Use the 2nd Engines to cover more often. Dispatch must be able to assign primary units more independently.
7.	[Allow more flexible use of second engines (squad model)][Formalized/automated system for Dispatch to move units][Other][Staff auxiliary rigs with additional manpower]We should have more flexibility to use 2 engine halls for coverage. Perhaps trying to staff the Auxiliary rigs with extra manpower when available, so that when they are deployed we have the bodies on scene. Perhaps having a computer in the District chiefs office that would show where apparatus are currently located.
8.	[Allow more flexible use of second engines (squad model)][Other]1. Allow more flexibility with use of certain apparatus. (E47, E48)2. Allow more flexibility for D/Cs to set up coverage as circumstances dictate.3. Utilize auxiliary apparatus to a higher degree, providing a quick "CFD on scene" time while reducing travel and complexity.
9.	[Allow more flexible use of second engines (squad model)][Other]LESS RIG MOVEMENTSECONDARY APPARATUS NOT USED AS PRIMARY APPARATUSRETURN OF "SQUAD" ENGINES TO COVER
10.	[Allow more flexible use of second engines (squad model)][Other]Utilize more of the 2 engine halls for coverage provide additional equipment on the 2 person apparatus Automatic "Primary" designation for 2 person apparatus with the PSC
11.	[Allow more flexible use of second engines (squad model)][Other] dislike the cascading model, Are we wearing out some of secondary rigs sooner than we have planned for within the current replacement life span of the apparatus. Still think we need to be able to utilize second engines more often
12.	[Formalized/automated system for Dispatch to move units]Ability to know where rigs are from a DC's computer.
13.	[Formalized/automated system for Dispatch to move units]Create electronic version so that decisions can be implemented/tracked in a separate column.
14.	[Formalized/automated system for Dispatch to move units]exploration of automation to the system further integration of risk based deployment opportunities
15.	[Formalized/automated system for Dispatch to move units][Other]move up software more work on unit hour utilization and peak deployment better situational awareness for BC/Dist Chiefs for covering a station with an engine or secondary unit

16.	[Formalized/automated system for Dispatch to move units][Other][Increased education/ communication about the model] 1. provide more context and explanation about CFD's risk management approach to producing data etc. For instance, is there a relationship with the 15 year dollar loss by community plotting that is posted in fire stations? Is the probability portion of determining risk based only on historical occurrences, or are we moving towards a proactive approach which considers threats or emerging threats (this is not limited to only deployment model(s), but to many risks facing operations, employees, dispatch, etc. etc. 2. Clarity on the role and function, specifically to moving apparatus around, the 2 ADC's at the PSC have, as well as District Chiefs (a) during normal business hours, (b) outside of normal business hours, and (3) during large scale incidents. It appears the 2 PSC ADC's sometimes move apparatus unilaterally, and at other times in a more coordinated fashion with the District Chief(s) responsible for each affected district.
17.	[Formalized/automated system for Dispatch to move units][Other][Increased education/ communication about the model][Staff auxiliary rigs with additional manpower] 1) It's all about the number of people arriving first on scene. Staff auxiliary rigs appropriately (4 or a minimum of 3 which is pretty much done in every professional dept. except Calgary) and most of the problems go away.2) Dispatch often seems confused when moving apparatus. Better education to the dispatchers and limited capabilities of aux. apparatus.3) More command training for jr. personnel who are not being put in Command on a common basis earlier in their careers than ever.
18.	[Other]Adding Compressed Water extinguishers to secondary Apparatus, giving cress that staff these units the ability to contain small exterior fires prior to first in engine arrival.
19.	[Other]Re confirming critical stations based on data,
20.	[Other]The map should be labeled larger and more clearly for aux rigs.
21.	[Other]Use current data to develop guidelines. Review the guidelines more often and change if necessary.
22.	[Other]some input from end users
23.	[Other][Increased education/ communication about the model]Unifying / simplifying the shift engine moves calendar for training etc. Create shortcut to shift home page as "A" has done. Detailed explanation of the motivation for all these moves in a logical presentation. Feedback on results of this model.
24.	[Other][Staff auxiliary rigs with additional manpower] 1- If extra firefighters are available, they should be assigned to secondary rigs.2- Ensure Lts. are provided with ongoing command training.
25.	[Other][Staff auxiliary rigs with additional manpower] better education to the non-chief officer members on the floor. more auxiliary apparatus in the fleet. more stations with 2nd Engines.

19. And why do you say that? |

#	Response

1.	[Automating model would decrease work load]Reduce time and efforts of already Dist chiefs
2.	[Automating would allow guidelines would be consistently applied]Adding Automation and providing visual confirmation of moves would assist in ensuring no clusters of secondary apparatus coverage without adequate engine support.
3.	[Automating would allow guidelines would be consistently applied]Easier to implement.
4.	[Automating would allow guidelines would be consistently applied]Might standardize things as currently each D/C covers differently; although under the same set of guidelines. Would be dependent on the model and how it was developed.
5.	[Automating would allow guidelines would be consistently applied]consistency, allow for routine deployments to be considered automatically
6.	[Automating would allow guidelines would be consistently applied] if there is a preferred pre-defined model to be consistently applied, an automated process based on inputs should produce the desired results.
7.	[Automating would allow guidelines would be consistently applied] when it's visible, it makes it easier to make your decisions.
8.	[Automating would allow guidelines would be consistently applied][Automating model would decrease work load]Automating the system for training and day to day events would alleviate work load on the DCs and allow officers to see upcoming movements.
9.	[Not automating would allow system to be dynamic]I DON'T SEE HOW THIS COULD HELP
10.	[Not automating would allow system to be dynamic]It is a fluid situation
11.	[Not automating would allow system to be dynamic]More information is need for this question, because it is very unclear. Answers to this question therefore may vary greatly because of different interpretations of the question. If a system is "automated", then how can a person affect an application? Why do we call it "DYNAMIC" deployment? Presumably because it allows us to be flexible and nimble in managing our resources as a result of heightened situational awareness, switched-on Officers, active and thoughtful District Chiefs, an effective incident management system, proper and capable resource tracking, and a capable dispatch system. Automating the system, even partially, decays dedication to optimizing our organization.
12.	[Not automating would allow system to be dynamic]The current model allows decisions regarding apparatus moves to be determined by changing operational needs. Automation would remove options that are presently available (ie: move an available engine rather than a secondary apparatus to a non critical stn to provide better coverage). An automated system would not allow choices of which rigs to move, creating issues for rigs that may be scheduled for training, planning productivity chores such as building inspections or hydrant testing, station tours. As a Dist Ch, being involved with deployment allows me to be aware of what rigs are in what Stns. An automated process would potentially create unnecessary frustration.

13.	[Not automating would allow system to be dynamic]We are to dynamic to make hard and fast rules , we are better off letting the people on the street that use the system work with it . (District chiefs)
14.	[Not automating would allow system to be dynamic]We now have the flexibility to make decisions based on what District Chiefs see as critical especially during large scale events that require some creative coverage
15.	[Other]The question is constricting and misleading. Automation would help the rules to be applied consistently but that is self evident. It would be a definite step backwards for a good system that could be even better.
16.	[Too many variables for automated model]CHIEF OFFICERS NEED TO HAVE INPUT INTO WHO COVERS WHAT HALL
17.	[Too many variables for automated model]I THINK THERE ARE TOO MANY VARIABLES ON A DAY TO DAY BASIS TO HAVE AN AUTOMATED SYSTEM THAT WOULD WORK WELL. I WOULD HAVE TO SEE WHAT THE SYSTEM WOULD LOOK LIKE.
18.	[Too many variables for automated model]I think each situation is unique and automation may not capture that.
19.	[Too many variables for automated model]If automation means decision protocols that automatically send coverage then definitely no. There are multiple variables that must be accounted for to make the decisions that cannot be captured.
20.	[Too many variables for automated model]It removes even further thought's into why and when you move apparatus
21.	[Too many variables for automated model]Not sure what you mean buy automating, there are many times when adjusting the redeployment you have to be somewhat creative to make things work, and I know not everyone thinks the same way and to treat it the same way each time I just can't see working, far to many variables to be considered
22.	[Too many variables for automated model]To many human factors involved to place that responsibility with an automated system
23.	[Too many variables for automated model]To many last minute changes and or requests
24.	[Too many variables for automated model]To many variables to account for.
25.	[Too many variables for automated model]WOW due you even have to ask that. The knowledge and experience of what's going on in real time and all it's details and nuance is to important to be left to even HAL let alone a simple program.
26.	[Too many variables for automated model]With the day-to-day coverage required for training and incidents the system used has to be very flexible. Too many factors involved to be automated.
27.	[Too many variables for automated model]You probably couldn't consider all that needs to be considered

20. Do you have any other comments about the Dynamic Deployment model or suggestions for improvement? |

#	Response
1.	no
2.	Good overall product.
3.	no
4.	No.
5.	Not sure that's its necessary for the CFD to employ 2 x CFD members up at PSC, when we as District Chiefs are more than capable of doing this job. It would be a significant cost savings.
6.	I feel as long as there are available engines in the stations 12, 22, 23 only one of the stations need maintain a second engine, as they cover each other and are in relative proximity to each other. 5 engines is overkill. I feel R32 is not required in the north as with the opening of Stoney Trail R31 and R4 can cover the area completely. R32 would be better served in the SW eg. 20stn
7.	Thank you for evaluating our performance. Thank you for using a risk management approach in this evaluation process. Thank you for educating us on how we can affect better overall response by reducing our chute times, while NOT (simply) trying to drive faster to calls. Thank you for including an educational approach to this deployment implementation. It helps when we can better understand WHY we are doing something, and what the objectives are. Thank you for striving for all of us to give better service to Calgarians and our visitors. Thank you for asking our opinion and input.
8.	Staff auxiliary rigs appropriately and the current model works well. Otherwise, I would recommend that we go back to covering stations with an engine from a 2 engine hall.
9.	The only complaint I hear from officers is that they don't have an engine on their neighboring halls. An aerial covering #9 is not comfortable when there is a Haz mat covering # 25.
10.	Get the people on the floor involved we are the ones using the system ,
11.	Firefighter and public safety, proper equipping, and funding of a Fire Department should be based on proven well documented research. I have yet to see any support from any recognized fire service governing body that supports our deployment model.
12.	Utilizing the Second Engines during evenings and week ends
13.	No
14.	Utilize the second engines, I experienced many years of the "squad" model and it worked well, on the rigs themselves as a driver, a captain and as a records officer utilizing for coverage for both training and events. All through this I can' remember a time when there were issues as a result when that second engine wasn't available within their regular district. Maybe we should look at

	when these second engines are utilized we back fill with a secondary rig if they don't already have one to offset coverage required if the other engine was to get a call.
15.	Cascading should be limited to 1 or 2 districts over so that crews have a general knowledge of the area as opposed to moving units clear across the city.
16.	After quality information and training for all those involved, trust your people.
17.	Would benefit from software to recommend the moves to take away from humans doing it less consistently
18.	No
19.	Overall, I believe that the DDM is beneficial and has provided the citizens of Calgary better service from the CFD
20.	I WOULD LIKE TO SEE SOME STATISTICS ON CRITICAL STATIONS WITH 2 ENGINES. HOW OFTEN DOES A CALL COME IN FOR THE SECOND ENGINE WHEN THE FIRST ENGINE IS OUT.