

Framing and Leveling Preparatory Training for Large Force Exercises

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ABSTRACT

In 2008, a preparatory simulator exercise called Red Flag (RF) Nellis spin-up was conducted about a month prior to the live RF exercise. Units participating in Red Flag and similar Large Force Employment (LFE) exercises may spend months preparing warfighters to maximize training benefits. There are aspects of LFE, however, that cannot be practiced on local training ranges. These include for example ground and airspace procedures for large force packages, coordination with other elements of a strike package, coalition operations, and operations against dissimilar forces. This paper presents the reactions and operational experiences of how RF Nellis spin-up was framed, levelled, and conducted to address the SwAF live exercise objectives and training goals, with the support of training needs analysis.

INTRODUCTION

In July 2008 the Swedish Air Force (SwAF) participated in the world's largest military live flying exercise – Red Flag (RF) for the first time. Seven JAS39 Gripen fourth-generation fighters and 14 pilots deployed to Nellis AFB, Las Vegas, NV, for the two week exercise. The exercise is managed by the US Air Force and the flying takes place over the Nevada Test and Training Range (NTTR). It is the largest of its kind in the world and by many considered as the most realistic training event available for military aircrew. During this specific RF exercise (RF 08-3) up to 65 aircraft flew two Large Force Employment (LFE) sorties per day over a period of two weeks. The Swedish unit that participated in RF 08-3 was the SwAF rapid reaction unit. They were all experienced, mission-ready pilots. In many ways the SwAF participation in RF 08-3 was considered to be not only an excellent training event but also a combat-like criterion of operative performance – a way of confirming developed tactics, techniques, and procedures (TTP) at an individual, team, and organizational level.

In order to prepare for the live exercise RF 08-3, the pilots of the SwAF contingent conducted a series of preparations: in the class-room, live at their squadrons, and in a simulator environment. One of the major preparatory events was the simulator spin-up exercise, called RF Nellis spin-up, at the Swedish Air Force Combat Simulation Centre (FLSC) conducted about a month prior to RF 08-3. This paper presents how the RF Nellis spin-up training was framed, levelled, and conducted based on training needs analysis together with operational experiences and reaction data from the training evaluation effort.

PURPOSE

Background

The SwAF runs programs for simulator-based training, research, and operational analysis at FLSC. FLSC mainly conducts training of fast-jet pilots and the facility is designed to provide experiences that develop the trainees' competence in decision making, planning, communication, tactical execution, and situational awareness. The emphasis is the development of skills, knowledge, and experiences on a team and inter-team level using eight fast-jet cockpits, four fighter controller stations, and one forward air controller (FAC) environment. Hence, although the primary training audience is fighter pilots, also fighter controllers and FAC can be trained. The main research activities are training

effectiveness and human performance, while the operational analysis program conducts simulator-based development and acquisition studies of systems, concepts, and tactics.

In 2006, FLSC delivered a simulator spin-up exercise for RF Alaska to the SwAF. This exercise was designed to cover the full mission cycles the pilots were to expect at the live exercise. The initial directive from the SwAF to FLSC for RF Nellis spin-up was to provide a similar type of training. However, based on experiences from the RF Alaska spin up, SME (subject matter expert) pilots argued for focusing on what was called domestics rather than tactical execution. Domestics in this case mean the specific settings, procedures, standards, and restrictions associated with the airfield, airspace, and the rules/regulations for the exercise. The most important experience from RF Alaska Spin-up was that the geographical and procedural familiarization the simulator exercise provided was extremely valuable during live execution. This is obviously one of the most important complements that simulated training has in relation to live training – the option of moving its users in time and space, such as evaluating different versions of a future sensor system or training in an unfamiliar geographical area beyond reach of live training. However, the value of having pre-trained the tactical execution in the simulator before live execution was considered less valuable with the argument that live execution of tactics in many cases and to a high extent is relatively independent of the location. This does not mean that pre-training of tactical execution over unfamiliar terrain is not valuable. The experience from the RF Alaska spin-up however, was that the value of the tactical training was considered significantly lower than the value of domestics training. It should be noted though, that these are experiences closely related to factors such as the fidelity of the simulation, the experience and readiness level of the participating pilots, and the objectives the exercise.

CONDUCTION

Training Needs Analysis Workshops

Based on the experiences from the previous spin-up, the decision was made to focus on the domestics during RF Nellis spin-up. The domestics were identified as: airfield orientation and taxiing procedures, range and target area orientation, communication protocols and procedures, airspace restrictions, and training rules and regulations. The high-level competencies that were desired to develop during RF Nellis spin-up came to be: familiarization with the geographical area especially the airfield and the airspace restrictions, fuel management, timing, procedures for ingress and egress, bomb drops in the target areas, taxiing procedures, threat handling, and to recognize important decision points. The top level objective for the spin-up preparations was established as to allow the pilots to focus their efforts and resources on the tactical execution during the live exercise to enable highest possible mission performance right from the start of RF 08-3.

Exercise Management

The white force and exercise management team was a blend of US and Swedish SMEs including an F-15 aggressor pilot from Nellis AFB. This team managed the exercise and provided communications for clearance delivery, Nellis AFB ground & tower, Nellis AFB arrival and departure, and AWACS (Airborne Warning and Control System) check-in. This collaborative effort was completed under a project arrangement between USA (AFRL Mesa, AZ) and Sweden (FLSC) called International Mission Training Research, IMTR.

Exercise Setup

RF Spin-Up was conducted over 3½ days. Day one included introduction and briefs on Nellis Air Traffic Control procedures for departure and arrival, familiarization with Nellis airspace, and a brief about the airspace. To achieve sufficient number of units during the domestic sorties, all manned pilot stations represented a unique unit. In that way they all became traffic to each other, instead of using Computer Generated Forces and a large White Force effort to simulate participating units.

Day two started with a brief on RF training rules followed by an airspace familiarization flight and practical application of the training rules in four vs. four scenarios.

During day three, two large force employment (LFE) scenarios were planned and conducted according to the authentic setup for the previous live Red Flag exercise.

Day four rounded off RF Spin-Up with one more LFE scenario and wrap up discussions. Also during the LFE scenarios, all manned stations represented a unit, tasked as offensive counter air (OCA) or air interdiction (AI) in the package. A large number of computer generated forces (CGFs), were utilized to represent hostile fighters as well as radar guided surface-to-air missile (SAM) systems.

Training Evaluation

Surveys were used to evaluate these training efforts, starting just before RF spin-up and ending after the last sortie at the live exercise. It was based on the Mission Essential Competencies (MECs) for JAS39 Gripen. The MEC method is a work analysis method that describes a professional’s competence on several levels (Colegrove & Alliger, 2003; Alliger, Beard, Bennett & Colegrove, in press). The MEC knowledge and skills (K&S) were used as fundament for the evaluation. During training needs analysis workshops with SMEs prior to RF Nellis spin-up, these K&S were mapped to the SwAF official training objectives enabling later quantification of fulfilment and assessment of training effects. The same set of surveys was used both during the spin-up and the live exercise. Castor, Borgvall, and Bennett (2009) provide an overview of the extensive training evaluation effort which comprises a number of different surveys administered repeatedly. The surveys were designed to cover all evaluation levels in Alliger, Tannenbaum, Bennett, Traver and Shotland’s (1997) augmented model of Kirkpatrick’s classical training evaluation criteria (1959a, 1959b, 1960a, 1960b). The reactions data presented below are divided into affective and utility reactions in accordance with the augmented model.

RESULTS

The majority of the collected survey data is not approved for public release with the exception of reactions and experiences data. Table 1 presents the reactions data to RF Nellis spin-up, collected after the spin-up and after the live exercise per dimension (Alliger et al., 1997) and category. The scale was: 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree. Four categories of reactions data were collected: spin-up opinions (affective), syllabus/mission flow (utility), home unit training (utility), and training value (utility). The questions for each dimension and category are presented in the Appendix.

Table 1
Reaction data to RF Nellis spin-up per dimension and category, collected after RF Nellis spin-up and after RF 08-3

Reactions dimensions and categories	Reactions after RF Nellis spin-up		Reactions after RF 08-3	
	M	SD	M	SD
Affective reactions				
Spin-up opinions (seven items)	3.14	0.44	3.01	0.65
Utility reactions				
Syllabus/mission flow (five items)	3.10	0.15	3.10	0.19
Training value overall (ten items)	2.51	0.67	2.33	0.75
Training value – spin-up related (four items)	3.18	0.49	3.05	0.53

Training Value – general (six items) 2.06 0.23 1.85 0.39

The reaction data shows a rather high consistency between the two occasions the surveys were administered. This means that RF spin-up was perceived as well designed, conducted, and valuable, both before and after exposure to the live exercise. In accordance with the design of the spin-up, the numbers for the spin-up related training value questions are high while the numbers for the general training value questions are distinctively lower.

The major operational experiences going from RF Spin-Up to the live Red Flag exercise are summarized below. Written statements were collected from surveys during and after RF Nellis spin-up and RF 08-3. In addition, verbal statements were recorded from the SwAF project officer for RF 08-3 during lessons learned and experiences workshop with simulator instructors, US and Swedish SMEs, and scientists involved in RF spin-up design and evaluation. This workshop was held about two months after the live exercise. The written and verbal statements have been clustered by Swedish SMEs to reflect the most important positive and negative experiences.

RF SME support. As previously mentioned, one RF Nellis aggressor pilot, three AFRL SMEs, and two AFRL researchers supported the spin-up effort. This group in combination with the Swedish SMEs, instructors, and researchers was the single most important experience identified. The areas generated when clustering the statements were:

- White Force with Red Flag SME support
- Red Flag SME briefings/tutoring

Some example statements in this cluster were:

- “Important to have had the in-briefs gone through by Nellis pilot at slow pace at home in order to be able to learn at Red Flag due to extremely high pace.”
- “Invaluable training to have SME personnel here with extensive knowledge of Red Flag.”
- “The briefs and tutoring by the Red Flag aggressor pilot supported the development of our preparations considerably.”
- “We should always work like this – to bring SME competence, such as the US support in this case, for future preparatory training and rehearsal.”

Domestics Training. The emphasis on rehearsing the domestics around the airfield and the training range with little emphasis on tactical execution was another crucial experience. The clustered areas were:

- Departure, recovery and arrival routes
- Specific radio communication standards and procedures
- Taxiing procedures
- Geographical knowledge – airfield and airspace
- Holding and target areas
- Distances and timings of the range
- Fuel management
- Airspace restrictions
- Training rules and regulations

Some example statements in this cluster were:

- “Once in Nellis, the spin-up preparations allowed us pilots to focus on mission related issues and the tactical execution instead of struggling with the complex domestics.”
- “Very positive experience, much better than the RF Alaska Spin-Up where we focused on tactical execution rather than domestics which in the end did not improve our preparations for tactical execution at that exercise particularly.”

- “The complex airspace around Nellis AFB was never an issue. The areas were quickly recognized as familiar from the simulator during the first live familiarization sortie at Red Flag.”
- “All procedures and airspace around Nellis AFB were presented in a very good way by the simulations and SME briefings.”
- “Invaluable experiences of fuel management, distances, and timings.”
- “Experience of radio terminology and procedures at Nellis AFB was crucial.”

The SwAF pilots committed no training rule or airspace violations at their first ever participation in Red Flag, a performance no other nation visiting for the first time have ever previously managed to achieve, and they were formally acknowledged by the Red Flag staff for excellent communications and ground operations discipline.

Scenario Layout. The design of the scenarios and the pace of the training at RF spin-up was another important experience with both positive and negative implications:

- Balance of complexity increase between the scenarios during the week
- Lack of GBAD threat level experience
- Limited red air exposure

An example statement for this cluster was “The heavy GBAD [Ground Based Air Defence] threat was a surprise to everyone. Even the first sortie without red air was challenging”. This was a particularly interesting experience since it is strongly related to the active choice of designing simulator scenarios with limited tactical elements that could provide such experience. In other words, had it been desired the pilots could have been exposed to these experiences during the simulator spin-up. Hence, the focus on domestics was very successful for the preparations but these two observations, the lack of GBAD and limited red air exposure, are examples of what the pilots missed due to limiting the tactical elements of the spin-up. The complexity increase of the scenarios during the week was considered well balanced.

DISCUSSION & FUTURE EFFORTS

In addition to the official acknowledgement relating to the SwAF pilots domestics competence and discipline, they also received acknowledgements of their tactical performance and their professionalism throughout the live RF, and Swedish pilots acted as mission commanders in three sorties. The SwAF project officer stated during the wrap up workshop that this could to a very large extent be attributed to the simulator spin-up training.

Further on, RF Nellis personnel concluded that preparatory training such as RF spin-up should more or less be a mandatory requirement in the future, especially for first-timers. Historically, training efficiency during RF Nellis exercises suffers severely due to lack of domestics’ knowledge and discipline, particularly at the beginning of each exercise. Large force exercises such as RF are very costly and there is a considerable cost-benefit payoff in preparatory simulator training. The aftermath is an ongoing discussion about developing formalized tools and simulations to provide such preparatory training to every nation going to RF.

It should also be kept in mind that the pilots who participated were all experienced and current combat-ready pilots. If less experienced pilots with a lower tactical readiness were to go to Red Flag the framing and levelling of the training would have to be carefully considered under the assumption they would need at least the same level of similar domestics training but also tactical training focused on the live exercise objectives. Structured training needs analyses with researchers and SME involvement early on during the planning of spin-up/rehearsal training is vital for successful this framing and levelling.

The report of a meta-analysis by Alliger, Tannenbaum, Bennett, Traver, & Shotland (1997) conclude that few studies of training present data and correlations between all the different levels of Kirkpatrick’s original taxonomy. One of the goals of this work is to analyze the effects of each measure but also to correlate between the levels of their augmented framework.

Yet another topic to address in future efforts based on this study is the perspective on transfer of training. Alliger, Bennett, and Tannenbaum (1995) presented two alternative views on transfer of training: “different task, same environment” transfer (typically laboratory studies) and “same task, different environment” transfer (typically studies of training and the on-the-job performance). This study could be considered to represent a third view, “different task,

different environment”, as the focus was to improve tactical execution at the live exercise by pre-training domestics in the simulator. The rationale is that preparatory training (in this study simulator training) on parts of the knowledge and skill set (in this case domestics) is transferred to another environment (in this from simulator to live) and thereby enables higher performance with lower resource demands (i.e. lower workload) on that set of knowledge and skills, leaving more resources available for other parts of the knowledge and skill set (in this case tactical execution) ultimately resulting in higher overall performance and increased learning from experienced events.

The present study can also provide insights on alpha, beta and gamma change (Golembiewski, Billingsley, & Yeager, 1976). In order to address validity issues during the analyses the study was designed to capture measures of any such alpha, beta and gamma changes, which means that calibrations of previous ratings were collected throughout the data collection (without presenting the previous rating). The idea behind this is that a person’s assessment of his/her current status can change as a function of (later) further exposure and experience.

In order to assess the training effect for the complete set of knowledge and skills, which can be described as the lion’s share of the pilots’ essential competence, comprehensive and structured assessment approaches such as the one described here are required when studying training in the field. Ultimately a mix of structured self-ratings, instructor ratings and logged performance data from simulator and/or aircraft would be collected. However, for studies of training with high ecological validity there are often issues with ceiling effects in the performance measures, such as number of air-to-air missile hits or bomb accuracy, especially when studying high performing pilots. This leads on to the almost the philosophical question whether training value and training effect are more representative constructs to evaluate than performance, although performance increases are the ultimate end goal of training.

Finally, the definition and formulation of organizational goals and training objectives is a challenge for both researchers and the operational community. An observation from this study, as in many others, is that if organisational goals and training objectives always were expressed in a clear and precise measurable form, training evaluation, and in the long run the training itself, could be further improved in less time and to a lower cost.

AUTHOR NOTE

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APPENDIX

Reaction questions per dimension and category

Affective reactions

Spin-up opinions:

1. Red Flag Spin-Up provides a realistic training experience.
2. I felt the time invested in Red Flag Spin-up worthwhile.
3. I expected more from this training than was delivered.
4. I would recommend this type of preparatory simulator training to future Red Flag participants.
5. The Red Flag Spin-up training was enjoyable.
6. I expected this training to be a valuable experience.
7. The missions and engagements were very challenging.

Utility reactions

Syllabus/mission flow:

1. The missions were sequenced in a way that facilitated learning.
2. The tempo of the training was appropriately paced.
3. The complexity increase during the exercise was balanced appropriately.
4. In training, I was able to apply lessons learned from previous missions to new ones.
5. The missions were presented in an organized manner.

Training value – spin-up related:

1. I am confident that I can perform the tasks taught in this training program in the field.
2. Red Flag Spin-Up has improved my preparedness for Red Flag.
3. I feel I will be better prepared to lead a mission due to this training.
4. The skills I trained in Red Flag Spin-Up are the same as those I expect to use in the field.

Training value – general:

1. As a result of this training I have improved my mission planning skills.
2. I have improved my tactical skills as a result of this Red Flag Spin-Up experience.
3. Red Flag Spin-Up helped me to improve my briefing skills.
4. Red Flag Spin-Up helped me to improve my debriefing skills.
5. Red Flag Spin-Up provides valuable experience in combat mission tactics.
6. Red Flag Spin-Up has helped me to improve my team coordination skills.