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Collecting Unsolicited User-Generated Change Requests

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THESIS

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Abstract

Unlike aircrew directly associated with acquisitions, line operators are not fully engaged in the methods to push materiel—hardware or software—change requests up the chain, to a decision maker, and then to the engineers. The Air Force trains these end users to logically apply expert systems knowledge to execute the mission but has not fully leveraged this resource for properly identifying and correcting operational shortfalls in an aircraft's design. Focusing on the Remotely Piloted Aircraft (RPA) community, the research goal is to determine if the Air Force should establish a formal program for collecting and prioritizing unsolicited user change requests from operators, and if so, how should the process be implemented and what characteristics should the system possess. This Delphi study sought consensus from a panel of MQ-1 and MQ-9 expert operators on desired characteristics and basic architecture. The analysis revealed that the deficiency reporting program, traditionally focused on Test & Evaluation squadrons, meets many of the desired characteristics but could be improved to meet all of them. Additionally, cockpit development could improve through supplementing the already established Cockpit Working Groups with a commercially developed tool with many of the desired characteristics.

Acknowledgments

I learned the value of having many advisors during the course of this paper. The paper would not have been possible without the members of the Delphi study; thank you for your opinions. I am indebted to my academic advisor, Lt. Col. Brent Langhals, who guided and mentored me through this past year. To my wife and children: I could not have gotten this far without your support and understanding. Finally, to the Source of all wisdom, thank You for Your blessings.

Joseph W. Goldsmith

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I. Introduction

General Issue

End users are often forced to support their commander's goals with less-than-ideal equipment due to requirements uncertainty coupled with ever-changing mission requirements. Potential improvement ideas, especially for complex solutions to complex problems, could be constantly elicited from the people who are most familiar with the current system's limitations: the end users also known as line operators. A continuous flow of end user feedback is a potential way to improve system performance through capturing evolving requirements.

Problem Statement

Unlike aircrew directly associated with acquisitions, i.e. assigned to the System Program Office (SPO) or flying with an operational or developmental test squadron, line aircrew are not fully engaged in the methods to push hardware or software change requests up the chain and to the engineers. The primary job of a line airman is to fly: combat sorties, combat-support sorties or basic mission proficiency sorties in preparation for combat or combat support. Collectively, line aircrew are the most knowledgeable resource for knowing how their particular weapon system is used operationally. This study specifically studies the RPA community—namely the aircrew associated with the MQ-1 Predator and MQ-9 Reaper.

Unfortunately, the Air Force has developed, but left partially untapped, this huge resource for properly identifying and correcting operational shortfalls in the design of

specific equipment. The Air Force favors technical degrees for aircrew and then trains the crewmember to logically apply expert systems knowledge to execute a mission. This training and background allows line aircrew to identify design errors of their weapon system in a variety of different applications. Unfortunately the deliberations of this valuable resource are often left to ferment at the lowest levels instead of being distilled into more capable, more effective, and more efficient equipment.

While the Air Force does have processes that allow user-initiated feedback, none of the current programs are oriented towards collecting software or hardware changes from individual line operators. Most aircrew are familiar with the Form 847—a program for changing publications such as operator technical orders or directive policies. Mirroring the operator's Form 847, the maintenance community developed the AFTO Form 22 with a similar functional effect for maintenance technical orders. Less known is the Form 1067—a method for operational and maintenance unit commanders to work together to modify a specific weapon system through adding bolt-on equipment. A key Form 1067 limitation is that the solution must be engineered locally effectively reducing the tradespace of hardware solutions to non-core functions and requiring already established interface standards for software solutions. The final feedback system is the annual Weapons and Tactics Conference (WEPTAC). While these conferences previously captured hardware and software change requests, current Air Combat Command WEPTACs de-scoped materiel solution discussion and focuses instead on Tactics Improvement Proposals (TIP); i.e. how to optimally use what we currently have. The author was unable to discover documentation on why WEPTAC de-scoped material solutions.

The Air Force has one feedback system that can accept unsolicited user inputs: deficiency reports through test & evaluation squadrons. Regretfully operator access to and knowledge of this program is lacking. This program documents areas where the aircraft does not meet requirements; however, the governing directives for the deficiency reporting program do not require that the test organizations collect deficiencies from operators nor does it explicitly define a deficiency. Deficiencies that impact safety of flight or risk mission failure are defined; however small problems, especially those where the specification does not meet the needs for the mission, are not clearly a part of the undefined term "deficiency" (AFI 99-103, 2013:86). The regulation does require OT&E to report features and defects of recently fielded software or hardware. One such briefing included an overview of future projects, a list of open deficiencies, and an appeal for operators to report defects in the new software since one full day of combat operations would log more flight hours on the new programming than all OT&E flights combined.

System defects are a subset of deficiencies; however, defects make up the majority of known deficiencies in the MQ-1. One deficiency report highlights the difference between a deficiency writ large and a defect. Current flight software has a defect where the distance setting for an automatic trigger only works as specified in the two most common control modes (local control and remote-split control) but not the other modes. The deficiency report accurately describes the defect; however, it misses a deeper problem: the trigger distance automatically activates both overt and covert emitters. The combined nature of the programming is not tactically sound over unfriendly territory. The author would like to separate a trigger for each of the emitters and was unaware of how to communicate this desire until performing this study.

Research Objectives/Questions/Goal

The end goal of the research is to determine if the Air Force should establish a formal program for collecting and prioritizing change requests from operators, and if so, how should the process be implemented and what characteristics should the system possess. Literature review will highlight ideal characteristics of feedback program and then evaluate current military and non-military feedback programs against those characteristics. Next the research will use a Delphi study to collect expert opinions from the operator community, synthesize the opinions into a consensus, and finally, determine the need for, the desired characteristics of, and basic architecture of, an operator-initiated feedback system.

Methodology

The research will be a Delphi study of the methods to capture, assimilate, prioritize and approve user-generated change requests. A Delphi study is a qualitative method for generating a consensus of opinion from a group of experts (Dalkey and Helmer, 1963:459). The group of experts is subjected to iterative rounds of questionnaires with controlled feedback in between the rounds. Unlike a round-table discussion, a Delphi study keeps the identities of the respondents withheld from the rest of the group. The latter stipulation seeks to harness the benefits of group discussion yet prevent direct confrontation and inevitable bias based on rank, position, passion, or oratory skills. Subsequent rounds of questions aim to consolidate the opinion and potentially introduce new materiel requested by an expert during the previous round.

A key component of the Delphi study is the experts selected for the discussion. The experts for this discussion will be limited to the RPA (Remotely Piloted Aircraft)

community inside of Air Combat Command. This scope allows a significant but not unwieldy number of participants, focuses the effort on a new and expanding enterprise, and engages a command solely focused on equipping mission capability.

The Delphi study will be traditional in that the participants will be anonymous and not directly interact with each other. This consideration is especially important as the rank and position difference between participants is projected to be rather high. Additionally, the study has the potential to highlight key mindset differences between subcultures inside the community. Moderated feedback is the best method to dissolve potential friction that could prevent a consolidated consensus.

Investigative Questions

As a Delphi study, the initial investigative questions will be directly delivered to a group of experts. The exact questionnaire can be found in Appendix B: Initial Questionnaire; however, a summary of the essential elements is discussed here.

This study seeks to determine if it is in the Air Force's best interest to establish a program to constantly accept operator inputs. Specific questions will determine desired stakeholders, the proper role of operators, and what aspects and characteristics of commercial feedback methods are desirable in the Air Force's RPA community. Other questions seek to determine specific implementation details such as the proper communication process, decision maker, and specific details captured in the feedback. The summation of the questions seeks both a qualitative and quantitative response to the potential to establish a new program.

Assumptions/Limitations

This research has the same limitations as other Delphi studies. Delphi studies operate under the assumption that multiple experts together will produce a better result than a single expert. A correlated assumption is that moderated feedback will eventually produce a consensus between the experts.

The major limitation is the scope of the study: a specific community (MQ-1 and MQ-9) further narrowed by inclusion of only one major command inside that community (Air Combat Command). The study and the concluding recommendations may not perfectly capture the needs of other commands or agencies—those that train and equip as well as those that execute the mission such as Special Operations Command.

Another potential limitation is the unclassified nature of the report. A participant may respond based on an experience with a classified program and the unclassified response would lack the broader context. Additionally some potential participants may choose to not participate because of fear of discussing any mission-related material in the unclassified environment. Cases of the former concern might be mitigated through additional communication at higher classification levels; however, such methods increase the risk of spillage and will therefore be discouraged.

Implications

In a static and perfect world, requirements would never change and the current systems engineering process would fully capture the needed effects. Neither of those stipulations is actually correct. First, the systems engineering process is not perfect: there will be some errors with the known requirements. A recent example is the addition of an automated weapons engagement zone (WEZ) display for the MQ-1 Predator. In 2013 a

new software revision included this display; however, the display was not built to allow timely updates for new missile variants and the accurate display was obsolete prior to operational release of the software. Second, the operating environment is not static: the nature of a particular mission changes over time, operators are constantly discovering new adversaries and environments, and strategic planners are always changing the required missions for airframes. For example, the Predator aircraft's mission started with reconnaissance in the Balkans, then added Close Air Support (CAS) and most recently adding Strike Coordination and Reconnaissance (SCAR) missions ("MQ-1B Fact Sheet," 2010; Payette, 2005; "Predator IOC," 2005). Between the errors in capturing requirements and the evolving mission sets, the known requirements of a weapon system will always be changing.

This study will increase the Air Force's understanding of the relationship between end-users and requirements generation. A key difference between this requirements study and most others is the origin and timing of the requirements generation. Most studies focus on communication methods initiated by acquisition officers or engineers to increase the accuracy, thoroughness, and stability of known requirements during initial development. This study opens discussion on formal, continuous feedback methods the end-user could initiate to update or correct known requirements.

Preview

The following chapters detail the literature background, methodology, analysis, and results of the study. Chapter 2 reviews academic literature on feedback methods, tools, characteristics and case studies; current military feedback systems for materiel and non-materiel feedback; and culminates in a critique of reviewed feedback programs

against ideal characteristics. Chapter 3 covers the methodology used to determine the Delphi panelists and surveys. The analysis of the surveys is contained Chapter 4, specifically which characteristics and implementation constructs the panelists were able to confirm; reject; or neither confirm nor reject. The final conclusions, including specific recommendations, are presented in Chapter 5.

II. Literature Review

Chapter Overview

This chapter describes in more detail a literature review of concepts introduced earlier. The first section identifies ideal characteristics of a feedback system based upon relevant literature and guiding directives. Next is a review of how the DoD generates requirements and a review of DoD formal non-materiel and materiel feedback methods. Following the DoD review is a review of commercial methodology including a sales representative interview, three feedback tools and two feedback case studies. A summary table with discussion shows which characteristics each of the tools meet and which they do not.

Characteristics of a Good Feedback Program

Prior to determining the best type of feedback methodology and building a program to execute it, the characteristics of a good program must be specified and discussed. The following categories define "good" based on a literature review covering feedback concepts, tools and case studies for a variety of end users.

A feedback program should exist

The most difficult part of designing a system is usually the proper understanding of the requirements to meet the desired effect rather than the design of a system that can meet the proper requirements (Kujala, Kauppinen, Rekola, 2001:49). This effect is most profound during initial systems engineering; however, as the environment in which the system operates evolves, user feedback ensures the system is constantly improved and adapted to the current environment (Hansson, Dittrich and Randall, 2006:5).

This improvement and adaptation requires more stakeholder input than just the developers of the system. System designers commonly fall in the trap that they think they know everything about an end user and their needs, but in reality they do not know what they do not know (Schneider, 2011:172). In an academic case study, experts identified areas they anticipated student feedback—44 in all. The case study system allowed any student to add extra areas if the students desired to give feedback in an area not identified by the experts. In the study, 43 of 44 of the expert-defined areas were effectively used, however students volunteered an additional 47 feedback areas. During the feedback review, the experts realized that 5 of the 47 volunteered feedback areas were worth further investigation and the experts had initially missed these feedback areas.

In the example above, the hierarchy between the experts and the students is rather flat. For larger bureaucracies, there may be several layers of supervision between users and the requirements experts. In bureaucracies, this characteristic decomposes into two areas: availability and advertisement to the line operator. Example programs are described later in this chapter.

Focuses on refinement of current functionality

Most users view new equipment under the paradigm of the current system's processes and assume any new equipment will be used in the same manner as the old (Kujala, Kauppinen, Rekola, 2001:49). In this regard, operators are keenly aware of current processes and can highlight the areas with the highest risk of mission failure under current constructs. Therefore, the feedback program should discourage discussion of novel concepts. Novel application of current weapon systems falls under the realm of the Tactics Review Board (AFI 11-260, 2011:7). Novel weapon systems designed to

meet new operational concerns are already covered with current JCIDS processes (JCIDS Manual, 2015: C7-8).

Clear methodology for soliciting and processing change requests

The SoftWare Engineering Body Of Knowledge (SWEBOK) captures best practices in software development. The latest guide recommends four basic actions for software change requests, although the core principles of the steps apply equally to non-software change requests (Champagne and April, 2014:pp 6-9). The SWEBOK recommended steps are: originating the change request (requirement update), enforcing the change process (review) flow, capturing the review board's decision, and reporting change process information. Other processes have clear methods for change requests but the SWEBOK steps demonstrate an example of the basic concepts behind clear methodology.

Encourages focusing feedback on actionable subjects

Unconstrained user feedback can include complaints on subjects that are outside the ability for the recipients to change or outside the scope of the system at hand (Schneider, 2011:165). A good feedback system focuses responses towards areas that are inside the available tradespace and discourages responses that are not (Schneider, 2011:166). This focusing could be as simple as pre-defining feedback subject areas, however focusing must be balanced with openness to unexpected, but potentially valid feedback subject areas. When balanced the feedback system collects useful vice distracting reviews.

Low user effort required

The value of unsolicited feedback from the field is that it captures the fleeting moment when a feedback idea is conceived rather than waiting for a solicited event. To maximize this effect, the system should be fast, cheap and easy for the user Schneider, 2011:166). Barriers to the fast, cheap and easy construct only serve to decrease the available feedback to the engineers. One method to decrease the effort is to pre-define feedback subject areas and to provide common or "canned" feedback messages. The case study used drop-down lists of entities available for feedback such as "Lecture on software modeling," "Usability Room," or "Online Registration System"; pre-defined modes such as "complaint," "complement," or "neutral comment"; and pre-defined options such as "not very usable" or "confusing presentation" (Schneider, 2011:170).

Automated triage of feedback

The nature of soliciting feedback continuously invites an opportunity for an overwhelming number of feedback entries (Gartner and Schneider, 2012:47). In order to effectively process the feedback without an undue requirement for a human's time, an ideal system would automate some of the initial triage of inputs. A prototyped technique for accomplishing the triage recommends counting both keywords and critical keywords then analyzing the frequency of the keywords in a specific feedback message compared to all feedback messages. This technique accommodates multimedia attachments; however, this feature was not tested in the case study.

Similar medium between feedback and object of the feedback

In a parallel to the adage "a picture is worth a thousand words" feedback that is not in the same medium as the object of the feedback is prone to unnecessary

communication errors (Rashid, 2007:372). The referenced article studied the applicability of using graphical feedback methods to capture change requests for a computer's graphical interface. Similarly, any feedback system must encourage users to submit feedback in the proper medium; text, chart, table, diagram, screen shot, and video are all potential means of communication. Feedback systems that accept various mediums of capturing the requirement decrease the amount of effort required from the user and promote more user involvement (Schneider, 2011:166).

Accommodating various mediums of user feedback is especially important due to trends in feedback. Generally speaking, users tend to seek improvements to the interface than the structure or functionality of the system (Kujala, Kauppinen, Rekola, 46). The value of improving the interface is displayed in the F-22 cockpit: the entire cockpit was designed to present the proper type and amount of information to the pilot in an easy to comprehend method ("F-22 cockpit," 2015). Allowing users to submit interface feedback in a graphical, pictorial, or videographic could assist in improving the interface quality.

Captures user context, environment, situation or background

A key objective of requirements elicitation is to understand the user's perspective. One of the first steps to understanding the user is to establish a user profile and capture the domain of the system under development or change (Perez and Valderas, 2009:5). As an adaptation of participatory design, feedback systems should segregate users based on common interests; in practice this means establishing multiple user profiles (Hansson, Dittrich and Randall, 2006:179). Each profile should include information covering the general skill, mindset or culture of the individuals using the system (Perez and Valderas,

2009:5). Finally, a specific user profile should automatically be associated the individual submitting the feedback without burdening the user to constantly generate their own profile (Schneider, 2011:166).

Domain information captures the physical, information, or social environment the system intends to operate (Perez and Valderas, 2009:33). The domain context also should include any adaptation in system behavior when subjected to different domains, such as the difference between the engagement area, the en route transit between engagement area and the airfield, and the terminal airfield (Knauss, 2012:346). Like the user context, this information is best when captured automatically; e.g. the system captures the time, date and physical location of the user when submitting feedback (Schneider 2011:166). Capturing the context assists designers developing more complete and accurate requirements.

Captures complete, consistent requirements

Users typically submit feedback in the form of natural language that allows for incomplete, ambiguous or internally inconsistent requirements (Pinto-Albuquerque and Rashid: 2014, 233). A review for incomplete requirements should check the chain of events from input to desired output; this process can be partially automated if the desired function is modeled in Unified Modeling Language and evaluated using an Event-drive Process Chain (Knauss, Lubke, Meyer, 2009:589). A second review of completeness should ensure the initiator captured any changes to the following elements of a requirement: constraints, user activities, data flow, quality and role of the requirement (John and Dörr, 2003:5). Additionally, six specific heuristics can check requirements for ambiguity and inconsistency (Pinto-Albuquerque and Rashid, 2014:236-238). Ambiguity

heuristics look for imprecise words, alternate grammatical constructs, and alternate contexts. Inconsistency heuristics search for quantified requirements that do not match related or dependent requirements. The precise heuristics used to check for consistency is not as important as the presence and effectiveness of a consistency review process.

Highlights potential for unintended consequences

Change requests based on one scenario may impact the way the system responds in other scenarios. The same inconsistency heuristics intended to check for consistency inside of a new requirement request can also highlight all the areas any proposed change would change system characteristics (Pinto-Albuquerque and Rashid, 2014:233). This allows any decision maker to properly assess the change prior to approval or prioritization.

Feedback initiators must trust their inputs have impact

Users providing feedback have an intrinsic desire to share their experiences and to improve the system they use (Schneider, 2011:166). In order to use product improvement as a motivator, the user must trust that their inputs have an impact on the final product. The principle of impact is shared with participatory design, however participatory design expands the definition to ensure that feedback participants are not harmed due to the participation (Hansson, Dittrich, and Randall, 2006:179). Ultimately, this impact is shown through changes to the final product; however, the initiator should get a response from the decision authority on the final status of the feedback—approved, partially approved, or rejected.

Current Military Requirements Methodology

The military has several methods for determining an individual system's requirements. The Joint Capabilities Integration and Development System initially identifies the requirements. During the lifetime of the system the Joint Lessons Learned Program, AF1067, and Deficiency Reports refine the initial needs.

Joint Capabilities Integration and Development System (JCIDS)

The Joint Capabilities Integration and Development System (JCIDS) governs the process of generating requirements for high level (DoD or service specific) military systems (CJCSI 3170.01I, 2015:1). At this macro level, the initial step is determining a capability gap. These capability gaps are identified in a variety of methods: Capabilities-Based Assessments; development of Operation Plans (OPLANS) and Concept Plans (CONPLANS) including Joint Urgent Operational Needs (JUONs) and Urgent Operational Needs (UONs); exercise or warfighting lessons learned; and technology demonstrations (JCIDS Manual, 2015:C3-8). Once the capability gap is discovered, the organization discovering the gap must formally review the gap to determine the appropriate response. The JCIDS Manual guides the decision based on validating the gap and assessing available assets as depicted in Figure 1. During the annual Capability Gap Assessment (CGA), these capability gaps are reviewed and stratified at the DoD-level (JCIDS Manual, 2015:BA1).

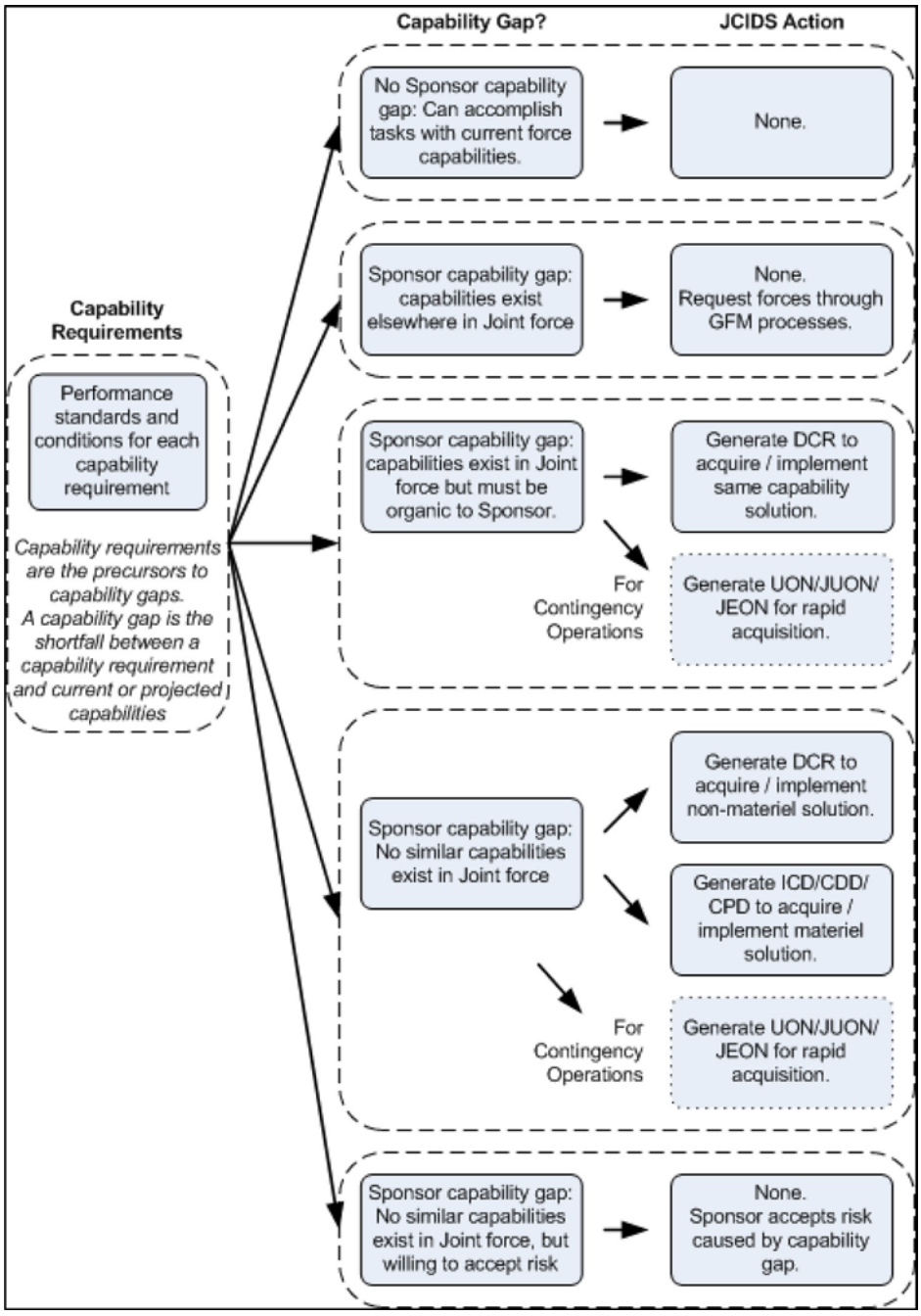
Capability Gap?
JCIDS Action
No Sponsor capability gap: Can accomplish tasks with current force capabilities.
None.
Sponsor capability gap: capabilities exist elsewhere in Joint force
None. Request forces through GFM processes.
Capability Requirements
Performance standards and conditions for each capability requirement
Capability requirements are the precursors to capability gaps. A capability gap is the shortfall between a capability requirement and current or projected capabilities
Sponsor capability gap: capabilities exist in Joint force but must be organic to Sponsor.
Generate DCR to acquire / implement same capability solution.
For Contingency Operations
Generate UON/JUON/ JEON for rapid acquisition.
Sponsor capability gap: No similar capabilities exist in Joint force
Generate DCR to acquire / implement non-materiel solution.
Generate ICD/CDD/ CPD to acquire / implement materiel solution.
For Contingency Operations
Generate UON/JUON/ JEON for rapid acquisition.
Sponsor capability gap: No similar capabilities exist in Joint force, but willing to accept risk
None. Sponsor accepts risk caused by capability gap.

Figure 1. Decision Tree For Capability Gaps (JCIDS Manual, 2015:C9)

Both the above process and the stratification are strategic in nature and cover the whole range of potential responses to a capability gap. What is notably downplayed is the role of the line operator. Of the handful of methods to discover a capability gap, only the 'lessons learned' has potential for tactical operators to directly contribute.

Joint Lessons Learned Program (JLLP)

Unfortunately, the current construct of the Joint Lessons Learned Program (JLLP) does not lend itself to dissemination at the lowest levels. The JLLP's stated mission implies operator involvement through, among other activities, discovery and dissemination of lessons across a wide variety of joint operations (CJCSI 3150.25, 2012:A1-2). This mission is delegated down to the service level (AFI 90-1601, 2013:5). While the program "encourages" all airmen to participate, the program is postured to have direct involvement only from the Lesson Learned team with indirect involvement from operators (AFI 90-1601, 2013:11). A brief survey of lesson learned content in the Joint Lessons Learned Information System (JLLIS) shows a recording of a variety of Doctrine, Organization, Training, materiel, Leadership, Policy and Education, Personnel, Facilities, and Policy (DOTmLPF-P) information, however the information is oriented toward operational-level information not system-level information. In short, the JCIDS process, even with the Joint Lesson Learned Program, does not capture operator-level information in a form that communicates the specific feedback that operators have, but are unable to deliver.

Air Force Form 1067 (AF1067)

Detailed operator input is needed for the proper development of a System Requirements Document (SRD). The purpose of the SRD is to translate an operational capability gap into acquisition requirements and is the responsibility of the DoD, not the contractor (Mil-HDBK-520, 2010:4; DAG, 2013:1143). In a parallel of the ways to discover a capability gap, there is only one tactical-level method to make inputs into the SRD development process: the Air Force Form 1067, *Modification Proposal* (AFI 10-601, 2013:8). While the SRD process has accurately captured that operators request new capabilities through the AF1067, this input method is hardly optimal as the AF1067's primary purpose is not to capture a capability gap (AFI 63-131, 2013:21). The mismatched purposes between the AF1067 and the SRD make the acquisition officer's job of incorporating operator input into the SRD challenging.

The *Modification Proposal* form, AF1067, is intended to request permission to modify a configuration item such as a weapon system as stated on the actual form duplicated in Appendix E: Air Force Form 1067. As a tool to capture a capability gap, the process is categorically flawed: AF 1067 only captures capability gaps to which an operator has already found a likely solution and which funding has already been earmarked (AFI 63-131, 2013:22). In this regard, the AF1067 is an effective tool to ensure the functionality of a weapon system is not impacted by a unit-requested modification of the system, but other capability gaps are not addressed.

AF1067 has been used with mixed results in the MQ-1 community. A successful example is the mounting of new monitor brackets for supplemental computer screens in the MQ-1 Ground Control Station (GCS). The original bracket configuration used

identical placement of computer screen mounts between several versions of GCSs. One particular model of GCS benefitted from moving the brackets to a new location to provide the operators more physical space (Goldsmith, 2011). The AF1067 allowed the squadron to formally request and Air Combat Command (ACC) and the MQ-1 System Program Office (SPO) to formally approve the bracket move.

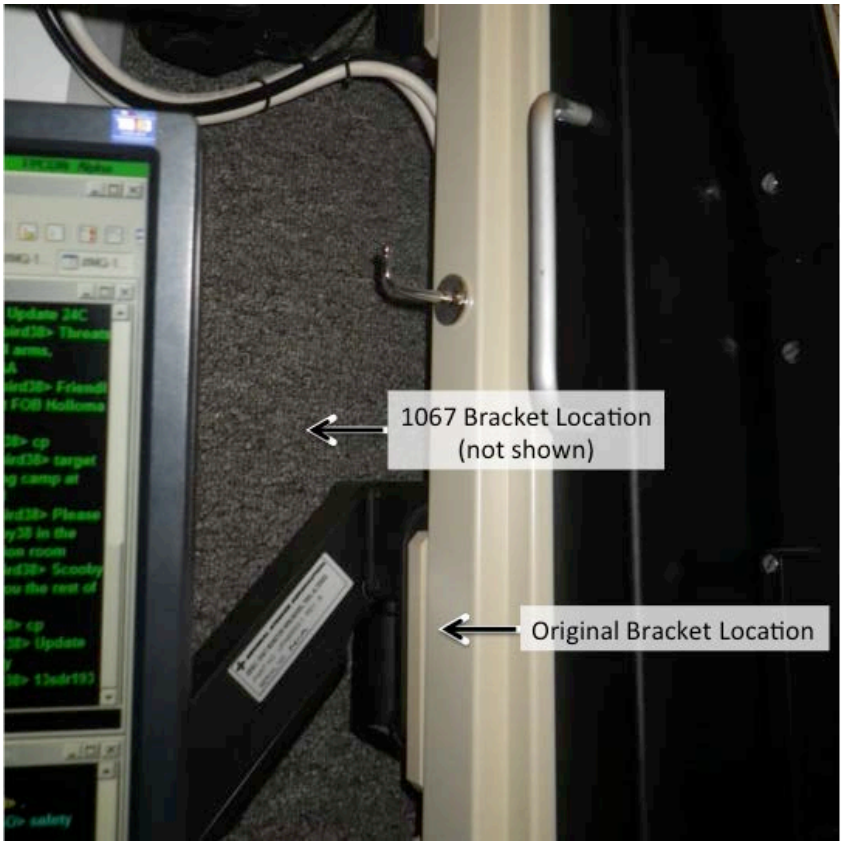

Figure 2. Picture of Ground Control Station Brackets

A later AF1067 was less successful. After a trend of near misses between MQ-1 and other aircraft in theater, the 20th Reconnaissance Squadron Commander looked for methods to alert pilots of factor air traffic (Goldsmith, 2011). Using a datalink tool on supplemental computers, aircrew had visual representation of the air picture. The

supplemental computer could generate an audio signal as an alert, however the computer was not integrated into the GCS audio panel. Using organic funding, the operators and maintainers built a simple, modest-capability modification to the GCS communication panel. The MQ-1 SPO approved a temporary AF1067 for testing the new modification. Although the test showed the modification performed as expected, the permanent AF1067 was rejected since a new acquisition program promised a timely development of an advanced audio suite with expanded and significantly more complex requirements. Unfortunately for the line operator, the advanced suite experienced programmatic delays from a late discovery of a non-functional security requirement while the simple solution was never approved nor implemented.

Cockpit Working Group

The Cockpit Working Group (CWG) is a group of various stakeholders, including operators, that advise an MDS's Program Manager with both technical guidance and an operational perspective (AFI 63-112, 2011:2). While the Lead Command selects senior aircrew to represent two staff agencies, line operators represent the MDS's current or future operator community, specifically as Cockpit Evaluation Team members (AFI 63-112, 2011:3). The CWG meets regularly and makes recommendations for cockpit modifications to the Program Manager.

Deficiency Reports

The last example of materiel feedback systems in the military is the deficiency report. Unfortunately "deficiency" is not explicitly defined in either the governing technical order or the parent instruction. Various sub-sets of deficiencies are defined and their summation says a deficiency is a quality, materiel, software, warranty, or

informational condition that is unsafe or limits the use of the materiel for purpose intended (TO 00-35D-54, 2011:pp 1-5 to 1-10). The deficiencies are discovered during inspections, engineering reviews or dedicated Test & Evaluations (TO 00-35D-54, 2011:1-4 to 1-5). The deficiency's originator submits the deficiency to the OT&E or DT&E Test Director who performs the initial review and prioritization (TO 00-35D-54, 2011:2-1). The Test Director submits the deficiency to the Program Manager. The deficiencies are reviewed and prioritized at a Review Board including the Test Director, Program Manager, a Lead MAJCOM representative and vested organizations inside the testing agency (TO 00-35D-54, 2011:2-2 to 2-3). The Program Manager, a member of the System Program Office and therefore Material Command, chairs the board (TO 00-35D-54, 2011:4-12). As an example the RPA Test Director and the MAJCOM representative both report to the Lead MAJCOM ("53rd Wing," 2015). The decisions from the review board are updated in a dedicated database (TO 00-35D-54, 2011:4-13).

The above process is oriented towards Test & Evaluation of operational conditions rather than end users in the actual field. Officially a deficiency's originator is "any individual" who discovers a deficiency and program managers must process Deficiency Reports (DR) "originating from any source," which could include end users operating aircraft in the field; however, the publication only requires action from testing organizations (TO 00-35D54, 2011:1-9 and AFI 99-103, 2013:59). Additionally, the regulations focus on the process to meet user needs but have a hierarchal definition of user:

> "User: Refers to the operating command which is the primary command operating a system, subsystem, or item of equipment. Generally applies to those operational commands or organizations designated by Headquarters,

> US Air Force to conduct or participate in operations or operational testing, interchangeable with the term "using command" or “operator.” In other forums the term “warfighter” or “customer” is often used. (AFI 10-601) Also refers to maintainers.” (AFI 99-103, 2013:98)

The different definition implies that the end users are able to use their chain-of-command to affect materiel change or that, as described in a later survey response, OT&E is the “voice of the operator” to both engineers and the MAJCOM leadership.

Informal Methods

The previous discussion focused on the formal methods of determining requirements—what is not covered is informal methods of feedback. By nature, these feedback methods are not structured and often only include the operator delivering feedback to someone who can influence the system design. Responses from the informal process are not always transmitted back to the operator involved. One final example from the 20RS highlights the informal methods. An operator noticed that the baseline GCSs did not have a particular software program present on a prototype-turned-operational version of the GCS (Goldsmith, 2011). The operator casually mentioned to the lead maintainer—a civilian working for the supplier—that the program would aid operator awareness of the aircraft and that the program was already built; it would just need to be installed on the baseline models as well. Approximately four months later, the program was installed as part of a previously scheduled software update. The operator does not know if the installation was a result of the conversation, which highlights the problem with the informal nature. Had the program not been installed, the operator would never have known why the request was rejected.

The previous review shows the formal methods found in documentation as well as a case of a potential informal method. The focus so far has been solely on military requirements generation leading to materiel solution. The next section covers programs in the military that accept operator feedback, however they do not give inputs to the requirements process.

Non-Materiel Military Feedback Methods

The Air Force currently runs other feedback methods for non-materiel solutions. There are two feedback methods that focus on the documentation and procedures of operating or maintaining an aircraft or a weapon system and two feedback methods that focus on tactics. The feedback methods for the publications are the Air Force Technical Order Form 22 (AFTO22) and the Air Force Form 847 (AF847). Through these two forms, stakeholders can recommend changes to guidance that require approval up the chain of command ending at either a System Program Office or a staff agency potentially as high as the Headquarters of the Air Force (HAF). The feedback methods for tactics updates are both conferences: the Tactics Improvement Proposal and the Weapons and Tactics Conference. These programs are detailed below.

Air Force Form 847

The AF847 is the official Air Force form for changing a publication (Appendix D: Air Force Form 847). The header information of the form shows the breath of coverage: feedback on any Air Force Instruction (AFI) or aircrew Technical Order (TO) is acceptable. A Technical Order is the authoritative source of information and procedures for operating or maintaining an aircraft. The form can have many originators but line operators and investigation boards as the most common source for change requests to

both TOs and operation-oriented AFIs (Program Office, 2014). The content of the form allows the originator to detail both the desired change and the rationale behind the change. Additionally, the originator lists contact information and forwards the change request up their chain of command (AFI 11-202v2, 2012:12). To be more precise, commanders in the chain delegate Form 847 supervision to their unit Standardization and Evaluation (Stan-Eval) shops and the originator forwards the request first to the unit Stan-Eval shop. For TOs, the request moves up the Stan-Eval chain to the MAJCOM level then over to the Flight Manual Manager at the System Program Office (SPO) for technical review (AFI 11-215, 2011:40). For publications, the request is up-channeled until reaching the publication's Office of Primary Responsibility (OPR) as defined for each publication. This OPR could be as high as the HAF staff, such as AFI 11-202v3, *General Flight Rules*, whose OPR is the Headquarters Air Force Flight Standards Agency (AFI 11-202v3, 2014:1). For either type of change recommendation, the originator's chain can reject the recommendation at any level and the originators are notified if their requests are rejected. Once at either the SPO or the OPR, recommendations may be deferred while awaiting additional analysis or closed with acceptance or rejection. Once closed, the OPR or SPO contacts the originator with the final determination, thus finishing the communication loop. Although limited to documentation and procedures, the AF847 program shows one method for capturing, processing and communicating change requests.

Air Force Technical Order Form 22

AFTO22 is a very similar form to the AF847, however its purpose is to update maintenance TOs rather than operator TOs (Appendix F: Air Force Technical Order

Form 22)(TO 00-5-1, 2014:1-1). The AFTO22 program follows the same basic flow: the originator is typically a line maintainer who submits the change recommendation to the chain of command who reviews the recommendation until an evaluator makes a determination. Again, upon closure the originator receives feedback on the final status. Despite the similarities, AFTO22 includes a significant difference: a discussion on the predicted savings in terms of both dollars and man-hours.

This addition speaks to the nature of maintenance vice operations: maintenance change requests are directly linked to the bottom line. Maintenance units track the money and manpower required to sustain a concrete metric for aircraft ability rate. Incremental improvements to the process will accrete into real savings through either materiel or manpower reductions. The same is not true for operations: incremental improvements may expand the upper bound of a system's effectiveness, but the upper bound is not often needed. An operator effectiveness metric is difficult to quantify and incremental improvements rarely results in the elimination of a whole crew position and the associated manning requirement.

Although maintenance change requests are more directly involved with saving money or time, neither process allows for changes to the aircraft to improve its operational characteristics or its maintainability. Both the maintainer and the operator are largely unable to initiate formal feedback on the weapon system under their care. This circumstance is mirrored in the civilian sector with notable exceptions in the field of software.

Weapons and Tactics Conference

The first of two Weapons & Tactics feedback methods is the Air Reserve Component (ARC) Weapons and Tactics Conference (WEPTAC). The ARC WEPTAC is a method for the ARC to prioritize capability gaps that require materiel or tactical solutions to properly steward limited financial resources (Vest, 2015). A select few members of each line squadron, commonly the squadron commander and the weapons officer, typically attend ARC WEPTACs. At the conference, these selected stakeholders represent their squadrons in prioritizing both materiel solutions and tactical testing with the intent to defeat the highest threat.

In contrast, current Air Combat Command WEPTACs do not focus on materiel solutions. This is a change from past WEPTACs that aimed to capture some feedback on materiel shortfalls (Goldsmith, 2010). ACC WEPTACs are focused on changing tactics to meet operational capability gaps; however informal discussions of materiel solutions may occur. The informal discussions may lead to either the MDS SPO or requirements Action Officer creating a Air Systems Requirements Council (ASRC) (Vest, 2015). An ASRC seeks operator input through voting on specific modification options such as airframe upgrades or pilot mechanization. The SPO or the Action Officers may request wing involvement via representatives, commonly a weapons officer.

Tactics Improvement Proposal

The last military method of feedback is the Tactics Improvement Proposal (TIP). A TIP is a non-materiel potential solution to a tactical deficiency (AFI 11-260, 2011:3). Users submit the TIP to the unit-level Weapons & Tactics shop. A TIP includes a description of the tactical problem, a recommended solution, and a recommended testing

plan with objectives. The review chain is through squadron, group/wing, Numbered Air Force, MAJCOM then finally to the Combat Air Forces. The CAF Tactics Review Board (TRB) consists of eight to ten people from MAJCOM staff, Test & Evaluation and operator communities (AFI 11-260, 2011:7). Any MAJCOM, including PACAF, USAFE, and AETC, may request representation at the TRB from the chair. The regulation does not require general announcement of the TRB results but the results of the ACC TRB are broadcast to the ACC WEPTAC—an audience that typically has representation from each unit and at every level from squadron to MAJCOM leadership.

Current Non-Military Methodology

The literature review detailed the role of sales representatives, two case studies of specific agencies that collected and processed change requests, three specific tools for gathering change requests, and multiple methods to condense broad data into actionable information. In general, the available articles discussing user-initiated feedback for software products vastly overwhelmed documentation of user-initiated feedback for physical products. Fortunately the lopsided representation does not impact the utility of the literature review: the concepts detailed in the articles apply to both software and hardware development.

A summary of the research is presented below, starting with the sales representative interview, then the case studies and finally covering available tools. The sales representative interview presents a method for physical product feedback. The first case study documents the change process for the Space Shuttle flight software—a government program with low tolerance for failure (DiVito and Roberts, 1996:3). The case study is actually focused on Space Shuttle integration with GPS, but the whole

change request process is summarized to provide context for the GPS modifications. The other case study details Idavall Data AB, a six-employee European business serving 1300 users from 300 organizations, mostly municipal governments (Hansson, Dittrich, and Randall, 2006:1). The three tools are also significantly different. ConTexter is a smartphone application that records semi-structured messages that could capture feedback on any program, organization or product (Schneider, 2011:166). OpenProposal is a graphical-oriented tool intended on capturing Graphical User Interface (GUI) change requests (Rashid, 2007:372). Finally, techniques to data-mine vast numbers of online customer reviews are reviewed (Somprasertsri and Lalitrojwong, 2010:938; and Zhang, Narayanan, and Choudhary, 2010:1).

Sales Representatives

Many manufacturers of physical products use sales representatives. A sales representative typically works in an independent firm and represents one or more companies on various lines of products. An interview with the owner of a sales representative firm for heat exchangers and other chemical process equipment revealed representatives also personify the customer when talking to the manufacturers (Bourgeois, 2015). The sales representative informally collects equipment feedback through on-site visits after initial installation and maintains communication through telephone or email. The customers rarely communicate independently to the manufacturers except for marketing and sales related surveys. When customers do talk directly to engineers, the sales representative is present—the sales representatives normally discourage exceptions to this cultural norm. In this manner, sales

representatives are often the voice of the manufacturer to the customer and the voice of the customer to the manufacturer.

NASA flight software changes

The NASA study showed that individual engineers initiate change requests with direct communication to other stakeholders, starting with written communication to a software requirement analyst (DeVito and Roberts, 1996:9). The software requirements analyst performs an informal review and returns the change request with comments. The engineer may iteratively ask for multiple informal reviews, however once the engineer feels the request is correct, he or she submits the change request directly to a formal review board.

The review board then prioritizes the formal submissions to undergo more scrutiny (DeVito and Roberts, 1996:9). The formal inspector follows a checklist of past problems to avoid and has periodic meetings with the stakeholders to ensure consistent understanding of the change request. Issues revealed during review are considered open until determined to not be a problem or until a solution is found.

The NASA case study documented a few problems with the review system as stated above. First, the inspectors had little methodology to perform the review—the list of past errors was not structured enough to guide reviews (DeVito and Roberts, 1996:10). Second, the review had no completion criteria—thoroughness was open to individual variance. Third, there is no structured method to document the depth of review, the understanding required to process the review, or the good aspects of the request. These three review deficiencies serve as a great lesson learned for future projects.

Once the review board certifies all the open issues with a change request are resolved, the change proposal is implemented; i.e. it is coded and incorporated into the baseline software. No formal communication to the other stakeholders is documented, although informal methods, such as supervisor feedback to the initiator, may occur without being documented (DeVito and Roberts, 1996:10). The change request is now closed.

Idavall Software Firm

The second case study has different methods for accepting user inputs. The Idavall staff uses multiple direct methods to capture needs from their users: helpdesk support calls, user meetings, and instructional courses (Hansson, Dittrich, and Randall, 2006:177). Users generally call the helpdesk when problems in the current software arise and the discussion often elicits a need for a new function. Additionally, all employees field helpdesk phone line, including developers, and hear user problems and mindset first-hand. Idavall also hosts eight-to-ten user meetings annually across three countries to informally disseminate news, discuss future development, answer questions, and generally establish a user community. The Idavall hosts encourage users to present new proposals at the meetings. Finally, Idavall conducts user classes, as the program requires some formal training. Like the user meetings, the teachers encourage students to submit feedback. In short, Idavall uses direct communication to capture change requests from a wide field of users mostly via phone call or in-person meetings. Extended iterative discussions were not present in the case study, but Idavall staff constantly interacted with their users.

The review process for Idavall is significantly more informal—planned meetings are rare, however informal meetings of the six employees occur often over coffee and lunch breaks (Hansson, Dittrich, and Randall, 2006:178). At these meetings change requests are ranked according to the universality, secondary effects, longevity, and impact of the change. The meeting concludes with an implementation determination. Like the NASA case study, no formal method of disseminating results was listed. Although the company disseminates news via its website, newsletter, and user meetings but no formal communication of implementation decisions, especially rejected requests, are documented (Hansson, Dittrich, and Randall, 2006:175).

Contexter Feedback Tool

The first feedback tool, ConTexter, also relies on direct communication, however the developers seek to focus the stream of feedback to into usable distinctions based on the context of the feedback (Schneider, 2011:168). Specifically the tool allows developers to pre-define entities that may receive feedback but also allows users to specify new entities. The entities are either physical items—such as computers, rooms, or weapon systems—or abstract elements—like lectures, organizations or job designations. After specifying the entity, the user then selects the type of comment (complaint, compliment, mixed or neutral). Finally the application allows the user to freely type the comment. Additionally the application records context such as the last website accessed and the physical location of the device. When completed, the application sends a message to the entity's owner, if a pre-defined entity is selected, or to the entire review board if the entity has not been defined. The scope of this tool ends

once the entity owner or the review board receives the message; it does not assist with review of the comment nor communicates the final determination to the originator.

OpenProposal Feedback Tool

Another tool, OpenProposal, focuses on allowing graphical, not textual, user feedback on the system's GUI followed by a period of collaboration on the change request (Rashid, 2007:372). The user feedback portion allows the user to take a screen shot of the current system and to annotate specific requirements. The user's annotations are treated as individual objects with amplifying details on the exact problem and the desired solution (Asarnusch, Wiesenberger, Meder, and Baumann, 2009:16). Once annotated, the proposal is saved in a database and is available to all stakeholders, thus OpenProposal is another method of direct communication, but the core message is graphical with annotated text.

The OpenProposal tool goes beyond collection of the requirement and also facilitates collaborative discussion between all stakeholders, including users, requirement analysts and software engineers (Asarnusch, Wiesenberger, Meder, and Baumann, 2009:15). Once submitted, the change request is stored in a database based primarily on which software object the change seeks to modify. Stakeholders access the database via the submission program (summary list only) and via a specially designed webpage. This website uses filters for specific users, historical web-addresses, and active applications to prevent information overload. After selecting a particular request, stakeholders can discuss the change request with each other. Specifically, end users can clarify requirements, requirement analysts can infer desirability, and software engineers can determine feasibility. OpenProposal does not currently offer any formal review tools,

just the stakeholder discussion, to assist the requirements analyst in determining which changes to implement and which to reject. Additionally, the tool did not discuss any formal communication contracts between the stakeholders, just that the tool offers a method to have the communication.

Data Mining

The final set of tools identified in the literature for processing user feedback is various different techniques for data mining online reviews of products (Somprasertsri and Lalitrojwong, 2010:938; and Zhang, Narayanan, and Choudhary, 2010:1). These tools allow producers to take advantage of the feedback online retailers are already collecting to assist fellow customers. These techniques revolve around semantic dissection then aggregation of all customer comments. The strength of data mining is the ability to reduce large quantities of raw data into applicable summaries; in fact the tools are only suited for that application. Data mining does not seek to capture, discuss, or transmit change decision; it just is a method to analyze current feedback.

Critiques of Current Feedback Methods

A summary of evaluating the reviewed feedback mechanisms against the characteristics of a good program previously reported is seen below as Table 1. The table graphically shows the strengths and limitations of the reviewed feedback methods.

Table 1: Summary of Current Feedback Critiques

	Available to / designed for any line operator	Advertised to all line operators	Focuses on refining current functionality	Captures complete & consistent requirements	Highlights unintended consequences	Clear methodology	Automated triage of feedback	Accommodates various feedback mediums	Captures user context/environment	Low user effort required	Focuses feedback on actionable subjects	Initiators trust inputs have impact
AF 1067	X		p[1]			X		p[2]	p[3]	p[4]		X
AF 847	X	X				X		p[2]	p[3]	p[4]		X
AFTO 22	X	X				X		p[2]	p[3]	p[4]		X
JLLIS	X		X						p[3]	X		
Deficiency Reports	X	p[9]	X	X		X		p[2]	p[3]			p[7]
Cockpit Working Grp	p[9]		X	X					X		X	X
ARC WEPTAC	p[9]			X		X			X		X	
TIP	p[9]			X		X			X	X	X	
Sales Representative	X	X	X	p[8]					X	X	p[8]	
NASA Space Shuttle	X	X	X	X	X							X
Idavall	X	X	X	X	X				X	X	X	X
Contexter	X	*	X					X	X	X	X	
Open Proposal	X	*	X	X	p[6]	X		X	X	p[5]		X
Data mining		*	X				X			X		

X=fully meets the characteristic
p=partially meets the characteristic
*=not applicable
p[1] – this method has significant limitations on changing system functionality
p[2] – these methods allow non-video attachments
p[3] – these methods have free text entry areas that may include context if the initiator is aware of the importance of context
p[4] – these methods have readily available assistance from program managers
p[5] – this program elicits more detailed and precise feedback than other programs; however, the program intends to ease the process as much as possible
p[6] – this program currently only supports informal reviews of the requirement
p[7] – initiators are typically have database access as they are not line operators
p[8] – most feedback is informal and relies on individual skill-level
p[9] – initiator commonly has informal contact with majority of unit-level operators

This summary reveals several key observations. First, no current method has all the characteristics, although the Idavall program and OpenProposal meet more characteristics than the others. Idavall's strength primary comes from the direct, iterative interaction between developers and users; this attribute accounts for six of their seven strengths. OpenProposal's strength is similar, however the direct, iterative interaction is accomplished digitally. OpenProposal's interaction includes three important stakeholders: requirement analysts, software engineers, and users interact with each other. The requirement analyst serves to address non-engineering limitations and sheds light on the process for getting the user's concerns addressed.

Secondly, the summary shows that many programs meet a characteristic only for a specific scope or under specific circumstances. This is most prevalent with the military feedback forms—each form is manually entered and has multiple free-text entry areas. The manual entry means the user has to spend some effort finding the proper data for the manual entry vice easier automation. Additionally, the free-text areas allow great flexibility and great potential for less-than-complete data entry. These partial areas could be made into full areas with some modifications.

Summary and Way Ahead

The above literature review describes current feedback systems and concepts in the DoD and the commercial sector. The chapter culminates with a summary table comparing current feedback methodologies with identified ideal characteristics. These characteristics were based on case studies and other literature. The comparison evaluated six DoD feedback programs and six non-DoD tools and methods.

The remainder of the research will examine which of the listed characteristics the operational RPA community consider important plus determine basic architecture of a desirable feedback system. The literature review broadened the field of characteristics included in the examination and provided a variety of examples of architectures. After examination, the literature provides examples for how to implement or further study characteristics or architectures deemed operationally important but lacking in current military feedback programs.

III. Methodology

Chapter Overview

The selection and execution of the research methodology is dependent on the research goals and limitations. The goal of the research is to determine the operator-desired characteristics and relative importance of operator-generated feedback without actually implementing the feedback program. This study employed the Delphi study method: a qualitative study method best suited for subject area with a lack of historical data and an inability to run experimental tests. The remainder of the chapter covers the justification for the Delphi study method, an expanded description of the Delphi method and the execution details—panelist selection, open-ended survey development, follow-on survey development seeking specific answers, consensus definition, and the termination decision for panelist involvement via surveys.

Why Delphi Method?

The purpose of this study is to determine the desired characteristics and relative importance of operator-generated feedback on Air Force weapon systems. This study does not seek to implement a specific feedback system and therefore is unable to experimentally derive conclusive data on the utility of such a system. Additionally, the lack of historical data prevents traditional statistical analysis. The lack of experimental or historical data is a key condition for implementing a Delphi Study (Rowe and Wright, 2001:135). Fortunately the Delphi Method is exceptionally useful in situations lacking conclusive data; specifically it evokes sharing and processing the collective knowledge and experiences of the expert panelists (Powell, 2003:380).

Delphi Study Method Overview

The Delphi method relies on the proper selection of experts composing the panel. The first criterion for an expert is the willingness and ability to make a useful contribution to the discussion (Powell, 2003:379). In the military, willingness to participate in studies is rarely a problem; being useful has different challenges. The two key factors in planning useful participants are to ensure individual members have the proper domain knowledge and the collective knowledge and expertise spans the full scope of the research (Rowe and Wright, 2001:127). Additionally, the research is more accurate when heterogeneous members are combined: this applies to both the different perspectives of the problem set and varying personalities of the members (Powell, 2003:379).

Expert Panel Selection

The expert panel is focused on the RPA community, specifically defined as the MQ-1 Predator and MQ-9 Reaper. Five perspectives relate to the requirements generation process and its impact: the line operator, the weapon school, the test & evaluation squadron, the system program office, and ACC's Directorate of Plans, Programs and Requirements (ACC A5/8/9). Despite the general lack of requirements generation process knowledge inside the line operator community, a panel discussing line operator inputs should include their perspective to fully cover the scope of the topic. To mitigate the knowledge gap, line operators with previous experience with another perspective were selected. The 26th Weapons School (26WPS) is the pinnacle of tactical expertise and the hub of emerging combat capability for the RPA community. Additionally they host the RPA working group for the ACC WEPTACs. The 556th TES

provides developmental testing to the RPA community and briefs the community on aircraft or flight software modifications—they are most visual segment of the acquisitions process to line operators. The MQ-1 and MQ-9 SPOs are the link to the engineers who would be responsible for producing and manufacturing any modifications to the aircraft. Finally, the ACC A5/8/9 is the lead major command (MAJCOM) for RPA and, as such, the final authority on RPA requirements. These five perspectives encapsulate the requirements generation process and its relationship with line operators.

There are two additional considerations for selection. Fortuitously, one of the operators also assisted the Air Force Scientific Advisory Board (SAB) as an Executive Officer. The SAB advises the Secretary of the Air Force and the Chief of Staff of the Air Force through identifying technology that can improve or create Air Force capabilities (USAF Scientific Advisory Board: 2015). The other consideration is the desire to have a broad array of ranks, crew positions, and operational backgrounds. RPA have two crewmembers: a pilot and a sensor operator. Sensor operators are effectively, but not officially, enlisted aviators. Their collective expertise includes the operator, test & evaluation, and some SPO interaction. Sensor operators with appropriate knowledge are typically Technical Sergeants (TSgt) or higher. Pilots are rated officers who span all of the perspectives and generally meet a high level of knowledge as a senior Captain. Experienced RPA pilots generally have completed either pilot training or navigator training prior to cross-training as an RPA pilot. New RPA pilots only have experience with RPA; however, this community is not represented due to the relative inexperience in the airframe. Finally, the line operators were selected from the RPA schoolhouse at Holloman. This scope is deliberate: schoolhouse members are combat experienced; have

exposure to multiple operational theaters, varied types of acquisition support, and the doctrinal mission requirements; are more open to share in an unclassified environment; and have a reduced operational tempo leading to a higher likelihood of survey completion.

Once selected each panelist was assigned a phonetic alphabet codename in order discuss specific responses while protecting the panelist's actual identity. For example, "Panelist Charlie" has advised the Scientific Advisory Board. The order of the panelists does not follow any particular convention. This naming convention is consistent throughout the survey analysis and conclusion.

Goal of the Questionnaires

The first questionnaire is aimed at qualitatively identifying the specific topics of discussion for the later rounds (Delphi Technique Myths and Realities, 3). This initial response will validate feedback system characteristics as described in Chapter 2. Further refinement of the panel's responses in subsequent rounds of questioning will transition from qualitative to quantitative assessment of the topics, mainly through generating a prioritized listing of key stakeholders, roles, and attributes. In addition to the lists, subsequent rounds seek to identify a potential feedback methodology for the RPA community and verify the key characteristics as delineated in Table 1 at the end of Chapter 2. The goal is to define both the key aspects and identify a potential way to execute a feedback program based on those aspects.

First Questionnaire

The questions inside the first panel survey are deliberately open-ended and allow the participants to answer freely on the topic of the survey (Powell, 2003:378). These

types of questions are designed to elicit responses that can be qualitatively analyzed; the analysis identifies specific discussion points for future rounds. The previous literature review has a limited role in the first round: concepts discovered bound the topic's discussion to a manageable and meaningful scope.

The initial survey (see Appendix B: Initial Questionnaire) seeks to capture the intersection between line operator inputs and how the Air Force generates requirements. Initially the survey captures key demographic information: education level, job title, flying qualifications, flying experience (measured in hours of military flight time), years flying in an operational squadron, and any interaction with the acquisition system. After the demographics, the survey examines the topic at hand. The five content questions are listed below:

1. Imagine that an Air Force system or Major Design Series (MDS) has recently reached IOC and is now used operationally. What stakeholders (individual job positions or communities of people) should have power to change the system to be more effective in future operations and why? Please list in priority order and include any discussion or justification you feel necessary.
2. What is your personal view on the proper role of end-users or line operators in the system modification or upgrade process?
3. If you could change one thing about the methods or process used to determine a system's requirements inside the DoD what would it be?
4. What are your top 2 or 3 preferred characteristics of any feedback system?
5. What type of information should any feedback system seek to capture?

The first question is from the acquisition community's perspective: as they manage a system's capabilities, how should they weigh the inputs from various stakeholders. The second question is from a user's perspective: how should they interact with the other stakeholders. The third question looks at the entire requirements

generation system and seeks to identify improvement areas. Like the first question, answers to Question 3 seek to show the relative importance of user input compared to other competing improvement efforts. The last two questions cover the ideal feedback system capturing both the non-functional requirements (Question 4) and the functional requirements (Question 5).

Converting qualitative responses into quantitative questions relies on statistical methods. The first round of questions has three distinct types of responses each requiring different analysis: prioritized, variable-length lists; non-prioritized lists; and unstructured, verbose prose. The non-prioritized lists are the easiest to quantify: the number of times a particular response is mentioned is summed across all responses. Similar responses are combined; i.e. similar means the responses had common or synonymous keywords. Prose responses will first be decomposed into individual phrases. These phrases will then be treated the same as the non-prioritized lists. The determination of similar phrases may be a more significant challenge than with a list; however, phrases with similar verbs and adverbs will be merged into one new phrase capturing the essence of both contributory phrases. Quantifying a set of prioritized and variable-length lists is more of a challenge than the other situations. To properly steward the participant's time, the panel will rank-order, but not individually weigh each item. Each item will then be assigned a weight-of-importance percentage according to the following formula:

$$Weight_n = \frac{N-n+1}{\sum_{c=1}^{N} c} \qquad (1)$$

Where N is the size of the participant's list and *n* is the rank of the item in the list

For example, a three-item list will have 50% weight on the first item, 33% on the second item and 17% on the third item. Once all the individual lists are weighted, similar

items across the entire panel's lists will receive a summed weight, by which the final, combined list is sorted.

Subsequent Surveys

Subsequent surveys transition from open ended questions to specific questions to continue validation of the key characteristics in Table 1 and identify a useful feedback methodology for the RPA community. Questions 1-4 of Survey 2 roughly align with the four basic steps of SWEBOK software change methodology described earlier in Chapter 2 linked here: Clear methodology for soliciting and processing change requests. Question 5 of Survey 2 seeks to capture the important elements for complete and thorough feedback. The questions will also avoid areas that already have consensus to focus on concepts that need more exploration to reach consensus. The entire panel's open-ended responses to Survey 1 will become the possible selections for questions in Survey 2. Survey 2's main questions are listed below with the entire survey found in Appendix C: Second and Final Questionnaire.

1. User involvement: Virtually all surveys indicated users should be involved in change requests to some degree. What user types of user involvement should be accepted?

2. Final determination: (a) Who should be the final approval authority for change requests? Assume the commander in question may delegate authority to a lower staff member for minor change requests. (b) Many responses indicated that decisions should not be made in a vacuum and other stakeholders should be able to influence the final decision on change requests. Who of the following should have influence or give suggestions about the change request? Check all that apply.

3. Vetting Process: Several responses indicated the need to filter feedback. The most common Air Force method is to have a functional chain of command sequentially review submissions. For example, the Form 847 is sequentially processed from the user to Squadron Standardization/Evaluation to Group Stan/Eval to NAF Stan/Eval to MAJCOM Stan/Eval. In contrast, a prominent commercial feedback model uses a group discussion between the user, requirements analysts, and

engineers to fully capture the requirement. Which of the following proposed methods would BEST facilitate timely and complete reviews of submissions?

4. Non-functional characteristics: About half of the responses indicated the feedback program should have good communication. Which of the following common architectures of data repositories would BEST assist good communication without sacrificing timeliness or inducing waste by excess communication?

5. Specific feedback items: If a feedback program were to exist, it should effectively communicate the change request and the complete context around the request. Rank order the following potential items based on their ability to support communication.

Along with the quantitative analysis, panelists are encouraged to provide justification for their responses in at least one question. Subsequent surveys will include both the quantitative analysis and the collective considerations from the panel (expert opinions in forecasting, 3). The inclusion of the rationales seeks to increase response accuracy through informing all panelists of potential aspects that might not have been considered while answering the first survey.

Additionally, the second questionnaire used the "Form" feature of Adobe Pro. Once configured, Adobe Pro can import individual surveys, collate the responses, and export the results as a single file. This method also reduces the effort required from survey recipients due to pre-formatted spaces for responses and the ability to digitally sign the initial release.

Role of the User

In Question 5 of Survey 1, panelists described the role of the end user. The vast majority described some method for end users to provide feedback; however, the exact method varied significantly. Question 1 of Survey 2 combined the answers from Survey 1 and presented them as possible selections to determine which types of user interaction are desired. Panelists could select more than one option if desired.

Decision maker and influencing members

Question 4 of Survey 1 provided a wide array of potential stakeholders in the change process. Question 2 of Survey 2 had two parts to capture the different aspects of stakeholders: the final decision authority and acceptable influence to that decision authority. In Part A, panelists had a choice between a two separate sole decision makers or a council. Members who selected "council vote" chose two-to-four voting members from a choice of four commanders. In Part B, panelists selected as many other stakeholders identified in Survey 1 as they felt appropriate to influence the final decision maker.

Vetting Process

Several responses to Survey 1 indicated the need to filter line operator's feedback. Question 3 of Survey 2 polled the panel for the best feedback method out of three sequential flows and two group discussion flows. The panel could also write-in their own flow. The basis for the options originated in Chapter 2 with specific inputs from Survey 1. A sequential vetting process occurs in most of the DoD feedback methods described in Chapter 2. The group discussion vetting process is detailed as part of the OpenProposal feedback tool.

Desired Characteristics

Questions 6 and 7 of Survey 1 allowed the panel to give open-ended feedback on current feedback methods. Question 6—the #1 item to change about requirements generation—focused on the negative aspects. Question 7—desired characteristics of a feedback program—focused on the positive aspects. Together the largest area of uncertainty is the best way to accommodate both timeliness and good communication.

Under the assumption that change requests would be tracked via database should a feedback program exist, Question 4 of Survey 2 polled the panel on the best implementation of a timely and communicative database.

Specific Feedback Items

The last question in both Surveys identified then prioritized all the individual items of feedback that should be included in a change request. The responses to Survey 1 were condensed into thirteen specific areas of feedback that conceptually cover the entire range of responses to Survey 1. Panelists ordered the group according to how a specific item would assist communication from the operator filling out the form to the decision maker deciding on the overall input.

Terminating the Survey Rounds

The main intent of subsequent surveys is to reach a consensus among the participants (Ryynänen, Karvoneni, and Kässi, 2008:1477). Consensus for this study will be defined as the responses show stability rather than attempting to reach a set percentage of agreement between the panelists (Rowe and Wright, 2001:128). This research is largely semantic rather than numeric, so variability cannot be measured. Instead, stability will be qualitative differences between survey responses. This definition sets a realistic goal, curbs the desire to add extra rounds to force agreements, and serves to eliminate additional pressure for participants to conform to the group averages.

In addition to overall consensus, the response distribution should be checked for bi-modal characteristics, especially given the distinct groups present in the panel (Powell, 2003:379). Bi-modal responses show a lack of consensus that needs further investigation, especially if the peaks correlate to distinct participant groups. This analysis

may be difficult due to the decreased size of individual panelist but could reveal biases inside the sub-groups.

Summary

The previous sections detail the Delphi method and how it will be implemented for this research. The end goal is to capture the answer to the investigative question presented in Chapter 1: what are desired characteristics and relative importance of operator-generated feedback in the RPA community. The answers to the overarching question will come from an expert panel spanning the entire requirements generation perspectives for RPA. Specifically, surveys will seek consensus among the entire panel and will cease when consensus is either made or assessed unlikely to be reached. Once the surveys are terminated, data collection is complete.

IV. Analysis and Results

Chapter Overview

The surveys were designed to capture the collective judgment of the panel on whether the Air Force should establish a program to collect unsolicited operator feedback, and if so, how should the program operate. The first section reviews the actual demographics and response metrics of the panel. Next the results of the surveys are broken into three major areas: consensus areas, non-consensus areas, and correlation between the panelist's desired attributes and the ideal characteristics identified in Chapter 2. The panel further explored two specific characteristics—clear methodology and capturing complete requirements.

Panel Demographics and Responsiveness

The panel started with fourteen members who indicated they were willing and able to respond to survey requests. Thirteen panelists completed Survey 1 and ten panelists completed Survey 2. The demographics are shown below. Many demographics show a numerical bias towards officer-pilots with operational experience in conventional operations, this bias is due to the majority of members in special assignments, such as TES, having the above-mentioned common background.

Table 2: Panel Demographics—Acquisitions Perspective

Acquisitions Perspective (panelists may have more than one perspective)	Accepted Panel Invitation	Responded to Survey 1	Responded to Survey 2
RPA Operator	11	11	9
Weapon School	2	2	1
Staff	3	3	3
System Program Office	3	2	0
Test & Eval Squadron	4	4	4

Table 2 shows the coverage across the five different acquisitions perspectives that span the requirements generation process. The large amount of operators was unavoidable: the majority of members in other perspectives had previous experience as a line operator. While none of the panel members with SPO experience, including an operator with SPO liaison experience, responded to Survey 2, significant portions of their perspective were communicated with two responses from Survey 1. However, the lack of SPO representation in the final survey is an area worth further investigation.

Table 3: Panel Demographics—Currently Assigned Unit

Currently Assigned	Accepted Panel Invitation	Responded to Survey 1	Responded to Survey 2
Operational Unit	6	6	4
ACC Staff	3	3	3
Test & Eval Squadron	3	3	3
System Program Office	2	1	0

Table 3 closely follows the previous table. While qualitative in nature due to the small sample size, the similarities indicate there may be only a small amount of cross-pollination between the perspectives. Many panelists shared the operator perspective

with another perspective but no panelists shared multiple perspectives between WPS, TES, SPO or staff. Additionally coverage of the various operational units required the high amount of operational unit members.

Table 4: Panel Demographics—Operational Experience

Operational Background	Accepted Panel Invitation	Responded to Survey 1	Responded to Survey 2
Conventional Operations	8	8	8
Special Operations	2	2	1
Unconventional Operations	2	2	1
Unknown	1	1	1

Table 4 shows the different types of operational experience present in the panel. The significance of the operational background is linked directly to different sources of funding and acquisitions for equipment. The high presence of conventional operations is mainly due to the desire for operators to have other perspectives and the high correlation between TES and Staff operators with only conventional experience. Two members shared operational experience between conventional operations and other backgrounds.

Table 5: Panel Demographics—Rank

Rank	Accepted Panel Invitation	Responded to Survey 1	Responded to Survey 2
E-5 to E-7	3	3	2
Captain (O-3)	3	3	3
Major (O-4)	2	2	2
Lt Col (O-5)	3	3	1
Civilian (GS)	3	2	2

The high potential for rank disparity was a major consideration for using a Delphi study vice a moderated panel. Table 5 shows the range of ranks considered experts and

therefore qualified as panelists. The staff and WPS perspectives have no enlisted members assigned and SPO demographic had no enlisted members available for the panel. This skewed the demographic towards officer influence. The operator perspective skewed the demographic away from civilian influence: no current operators are federal civilians.

Table 6: Panel Demographics—Crew Position

Crew Position	Accepted Panel Invitation	Responded to Survey 1	Responded to Survey 2
RPA Pilot	8	8	7
RPA Sensor Operator	3	3	2

The last demographic breakout, Table 6, shows the unavoidable bias towards pilot perspective. Like the rank demographic, the staff and WPS perspectives required pilots due to the requirements for a military member in those positions to be an officer and therefore not a sensor operator. One out of three panelists from both the operational units and the TES were sensor operators.

Consensus Area Summary

The goal of the surveys is to form consensus among the panelists. Since Survey 1 is typically open-ended, any consensus areas must be spontaneous and, in this case, only covers a rather broad statement. Specific consensus areas are listed in the sections below.

Survey 1 Analysis

There was one area of consensus in Survey 1: users have an active role in the requirements generation process. Of the thirteen responses to Survey 1, twelve members (92%) stated that operators should have an active role in the system upgrade or

modification process as shown below in Table 7. Panelist Golf stated that operators are "important" to the process, but did not specify the specific role of operators. More details are discussed below in the section labeled "A feedback program should exist."

Table 7: Survey 1 Consensus Summary

Statement	Agreement
1. What is the user's role in the system upgrade or modification process?	
Users should have an active role	92%

The open-ended responses about feedback systems in Survey 1 indicated a potential need for any feedback system to be timely as seven of the thirteen respondents volunteered "timely" or a synonym of "timely" as a top characteristic. Two panelists stated "advertisement" as a desired quality. Other volunteered characteristics had less duplication, but included transparency, accountability, clarity, accuracy, effectiveness, objectivity, responsiveness, and simplicity.

Survey 1 also revealed concerns about the requirements generation process outside of feedback systems. Two of the responses dealt with executing the results of the feedback: one lamenting the high cost of fixing "things that get missed," and one recommending open-architecture to decrease cost of upgrades through competition. An additional three responses lamented the lack of expert-based decisions—one explicitly requesting expert-based or analysis-based leadership decisions, one that recommends a warfighter's council of instructor operators and maintenance leads to review contracts before release, and one that laments the lack of expert operators available to advise other stakeholders during the early developing phase. Another panelist's comment recommends use of Federally Funded Research and Development Centers (FFRDC),

industry nodes, Air Force Research Labs (AFRL), and Defense Advanced Research Projects Agency (DARPA) to facilitate data-driven analysis of technical solutions to a tactical problem. Other responses included a request for streamlined transparency; agile development methods; modular systems design; open-architecture standards; increased adherence to human-machine interface standards; clear identification of high-level stakeholders; proper distinction between the Combatant Commands (COCOM) setting the required mission effect and MAJCOMs determining the derivative system requirements; and streamlined but consistent fielding processes.

Survey 2 Analysis

The ten respondents to Survey 2 answered all of the questions. Table 8 and Table 9 summarize the ten responses to all five questions, separated into consensus areas and non-consensus areas. Figure 3 summarizes the responses from Question 5.

Table 8: Survey 2 Consensus Summary

Statement	Agreement
1. User Involvement: What types of user involvement should be accepted?	
The Air Force should NOT seek unfiltered, unsolicited feedback	80%
The Air Force should NOT seek feedback vetted only through commanders	70%
2a. Who should be the final approval authority for change requests?	
The final decision authority SHOULD be the Lead MAJCOM	70%
The final decision authority should NOT be the "Lead" COCOM	90%
The final decision authority should NOT be a Council Vote	80%
2b. Who of the following should have influence or give suggestions about the change request?	
HAF should NOT influence change requests	80%
The lead MAJCOM SHOULD influence change requests	100%
Any MAJCOM SHOULD influence change requests	70%

The "lead" COCOM should NOT influence change requests	80%
Any COCOM should NOT influence change requests	80%
The Test & Evaluation Squadron commander SHOULD influence change requests	80%
3. What review process would best facilitate timely and complete reviews of submissions?	
A group discussion with user, TES, decision maker's staff is NOT the best review	100%
4. What data architecture would BEST assist good communication without too much communication?	
A pull system (i.e. individuals must periodically check the library for relevant submissions) is NOT the best method.	100%
A push and a pull system (i.e. individuals may both seek out relevant submissions and be automatically notified when submissions of user-defined criteria are created) is the BEST method.	70%
A limited-access online library where only trusted agents (i.e. not line operators, just the change-request processors) have access is NOT the best method.	70%
5. Relative Importance of specific items of a change request. Do you agree with the average ranking (+/- 1 positions)?	
Attachments	70%
Temporary solution	70%
Reviewer comments	80%
Reviewer's information	80%

Table 8 provides a summary of Round 2 responses that show consensus in the participants; defined as 70% or higher agreement. Nineteen of thirty-seven responses had partial to full consensus, as reflected with green shading. Three responses had unanimous agreement and are shaded blue. Narrowing the focus on Questions 1-4 reveals that ten of fifteen consensus areas—i.e. two-thirds—rejected rather than affirming a particular statement. Essentially the panel typically knew what was not desirable rather than what was desirable.

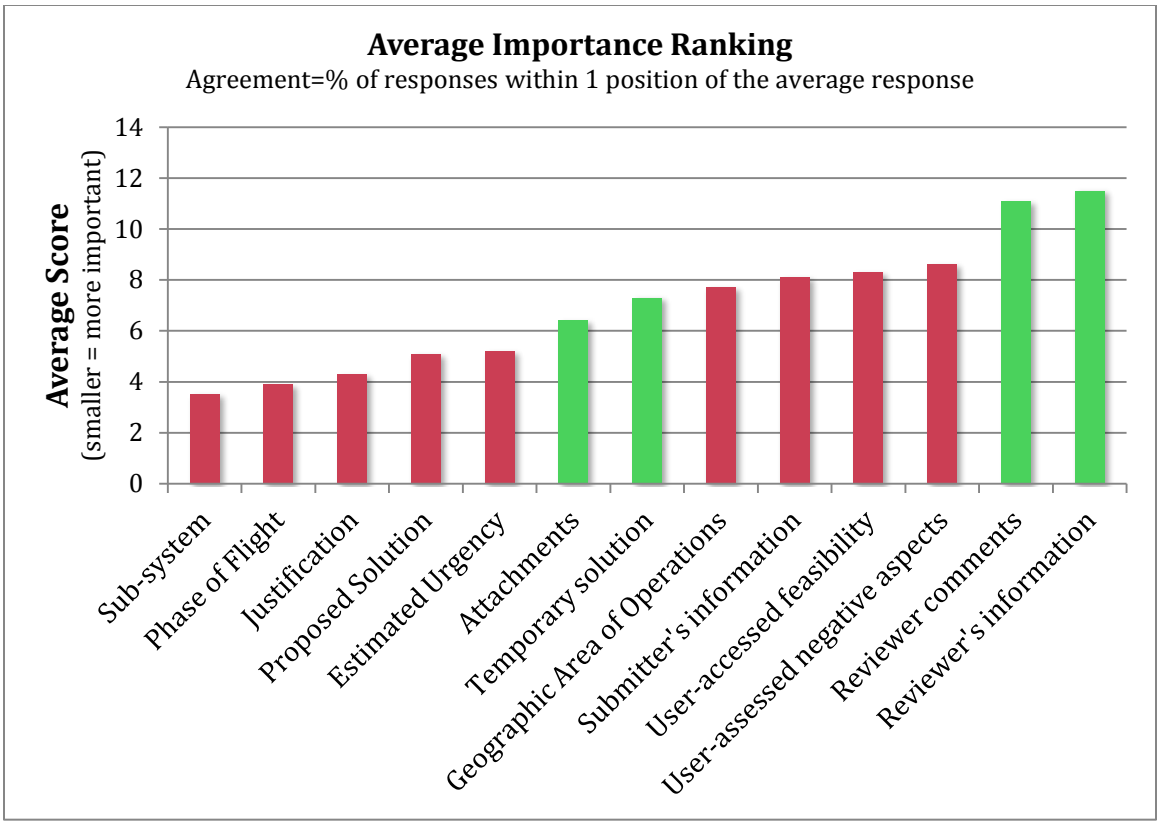

Figure 3: Average Importance Ranking For Specific Data Fields

Figure 3 shows both the average results for the relative importance of specific feedback items for a change request. Agreement for this question is the percentage of responses that are within one position of the entire panel's average. Columns shaded red have less than 70% agreement; columns shaded green have 70% or more agreement.

Table 9: Survey 2 Non-consensus Summary

Statement	Agreement
1. User Involvement: What user types of user involvement should be accepted?	
The Air Force SHOULD seek Feedback vetted through functionals	50%
The Air Force SHOULD seek Feedback through formal studies or currently established feedback systems	60%

2b. Who of the following should have influence or give suggestions about the change request?	
The weapons school commander SHOULD influence change requests	60%
Any commander SHOULD influence change requests	50%
3. What review process would best facilitate timely and complete reviews of submissions?	
The best review is a sequential flow: User→Squadron Weapons and Tactics→Group Weapons & Tactics→decision maker	20%
The best review is a sequential flow: User→Squadron Weapons and Tactics→Group Weapons & Tactics→Operational Test & Eval Squadron→decision maker	20%
The best review is a sequential flow: User→Operational Test & Eval Squadron→decision maker	20%
The best review is a group discussion with user, SPO, decision maker's staff	20%
The best review is a group discussion not listed on the survey	20%
5. Relative Importance of specific items of a change request. Do you agree with the average ranking (+/- 1 position)?	
Sub-system	60%
Phase of Flight	60%
Justification	60%
Proposed Solution	50%
Urgency	20%
Geographic Area of Operations	30%
Submitter's information	20%
User-accessed feasibility	30%
User-assessed negative aspects	60%

Analysis Framework

There were two goals of survey analysis. The first goal is to determine the correlation between the panelist's responses and the ideal characteristics discovered during the literature review. The second was to define specific methods to attain two of the attributes: clear methodology and capturing complete requirements. For the first goal,

Survey 2 explicitly confirmed six characteristics and rejected a characteristic but was unable to confirm or reject three characteristics. Clear methodology had four parts corresponding to the first four questions of Survey 2. Two of these questions had significant consensus; two did not. The definition of complete requirement capture started in Survey 1 and was expanded in Survey 2. Four of the thirteen individual feedback items had consensus for their relative rank on an importance scale. Of those four, the rank of two items has significance for implementing a program. A summary of these results is below.

Table 10: Panel Assessment of Ideal Characteristics

Ideal Characteristic Identified in Chapter 2	Panel Assessment
A feedback program should exist	Confirmed
Focuses on refining current functionality	Confirmed
Focuses feedback on actionable subjects	Confirmed
Accommodates various feedback mediums	Confirmed
Captures user context/environment	Confirmed
Initiators trust inputs have impact	Confirmed
Highlights unintended consequences	Rejected
Low user effort required	No assessment
Automated triage of feedback	No assessment
Captures consistent requirements	No assessment
Captures complete requirements	Further explored
Clear methodology	Further explored

Additionally, the responses from panelists that have staff or Test & Evaluation experience were separated to look for significant differences in demographics. Responses from the Weapon School and System Program Office perspective were not independently evaluated due to low turnout in those areas. The Operator perspective was not independently evaluated since all but one Survey 2 respondent has operator experience. For Questions 1-4, significant deviation from the whole panel is defined as

exceeding half a vote divided by the number in the demographic. For example, if 50% of the whole panel agreed on a question and 2 of 3 Staff panelists agreed, the deviation is not significant (50% is within 1/6 of 67%). Conversely, if 70% of the panel agreed and only 2 of 4 Test & Evaluation panelists agreed, then the deviation is significant. For Question 5, significance is defined as an item whose rank moved three or more positions.

Confirmed ideal characteristics

The panelist's desired characteristics have significant overlap with the ideal characteristics discussed in Chapter 2. The sections below describe the areas of overlap.

A feedback program should exist

Twelve of thirteen respondents in survey 1 indicated that operators should be involved in the requirements process. Panelist Golf indicated that operators are important in the process of system modification, but did not say that the operators should be directly involved. Nine of the responses explicitly stated operators should give feedback on the functionality of the system. The remaining three responses discussed the need for operator involvement during requirements development, but did not explicitly discuss feedback.

Focuses on refining current functionality

In Survey 1, a majority of respondents identified the need to capture a proposed solution to particular problem and/or the current effectiveness of the system. In Survey 2, the respondents ranked two individual feedback items for usefulness: the proposed solution and justification. Both of these items seek to improve the function of a system. The proposed solution describes a potential fix to a problem and was ranked number 4 of 13. The justification describes the problem as it relates to either safety or mission and

was ranked number 3 of 13. Of note, the staff demographic ranked the proposed solution as number 1.

Focuses feedback on actionable subjects

The environment this feedback system would exist is already somewhat focused. First, the feedback is limited to only materiel problems. Concerns with non-materiel problems, such as tactics improvements, are captured via the processes described in Chapter 2. Second, the feedback is focused on a single aircraft series. Even still, the panel did confirm two ways to focus feedback.

Focusing feedback has two distinct subordinate concepts: identifying a feedback item that can focus feedback and allow users to see the areas that other users have provided feedback. Both of these concepts were confirmed in Survey 2. First, the average ranking for the "sub-system" feedback item was first place meaning it was the single most important piece of information presented in the survey. Second, the panel rejected the "trusted agent" data-architecture option and confirmed the "push and pull" method of disseminating previous feedback areas. Disseminating the approved areas of feedback is a key piece to focusing feedback towards actionable areas.

Accommodates various feedback mediums

This characteristic was the genesis for the potential feedback item of "Attachments to support videos, pictures, or other non-textual feedback" option for Question 5 of Survey 2. This feedback item was not mentioned in Survey 1, however it received a strong ranking: sixth out of thirteen. Additionally, it was one of the few items that was consistently ranked. Seven of the ten respondents ranked "attachments" between fifth and seventh in importance.

Captures user context and environment

This characteristic also drove two individual feedback items for Question 5 of Survey 2: "Phase of flight," and "Geographic area." These two items are an adaptation of the context captured via the Contexter feedback tool. The Contexter tool also relied on user's profile information, however "Submitter's information" was already a part of the potential list of feedback items. Two items—Geographic Area and Submitter's Information—ranked somewhat low on Survey 2 scoring an average of eight and nine out of thirteen respectively. "Phase of Flight," however, scored extremely well at second of thirteen. Additionally, the Test & Evaluation demographic also ranked "Phase of Flight" as number two. This breakout is significant because the Test & Evaluation Squadron's own feedback tool does not directly record this item.

Initiators trust inputs have impact

The panelists indirectly confirmed the need to trust the feedback system in Survey 2. Starting in Survey 1, roughly half of the panelists remarked that an ideal feedback system needed good communication via either transparency, accountability, advertising the results, or clarity. In Question 4 of Survey 2, the panelists confirmed the ideal data repository to increase communication and therefore increase the potential for trust.

Rejected ideal characteristics

The panel rejected one of the ideal characteristics discussed in Chapter 2. The section below describes how that characteristic does not apply to the RPA community.

Highlights unintended consequences

This characteristic was introduced as an option to include "User-assessed negative aspects to the change request" as a specific area of feedback. This specific feedback item

was rated as rather unimportant in Survey 2 (11 of 13). This is most likely due to the differing roles the panelists perceived in the feedback process. Operators may understand the negative impacts when requesting a change to the interface; however, operators expect engineering reviews to determine any negative consequences. This is reflected in the panel's low ranking of user assessments.

Characteristics neither confirmed nor rejected

The panel did not explicitly confirm nor deny any of the following ideal characteristics. Generally speaking, the panel did not volunteer the following areas as areas of concern during Survey 1.

Low user effort required

This characteristic was not fully investigated because the panel did not explicitly state a desire for an easy feedback method. The literature review discussed how to decrease the amount of effort required to submit feedback and specifically recommended a semi-automated smart-phone application. That specific solution is not practical for military aviation—the simplest solution is to fill out a form and email it straight to the appropriate point of contact (POC). The key element of this "simplest" solution—the direct communication with the POC—was presented to and rejected by the panel (80% did not recommend direct, unfiltered communication). That said, other methods of easing the difficulty of sending feedback were not investigated.

Automated triage of feedback

In addition to the previous characteristic, automated review of feedback was not mentioned in the surveys. The core of this characteristic is a time saving method for reviewing large numbers of individual reviews. This concern was reflected in Panelist

Hotel's comments on Survey 2: "having a vetting process locally will help MAJCOM and staff focus the limited resources." Fitting with this sentiment, the Panel assessed multiple potential vetting process flows but no automated flows were evaluated.

The broad desire for human review over automatic review is not surprising given the difference between the intent behind the military and commercial feedback process. The literature review discussed methods to condense a multitude of online reviews into the key features. However, the original purpose of an online review is to advise any potential buyers in making the decision between buying one out of a group of similar products. Operator feedback in the military is focused on comparing a single product, often the only one of its type, to the stated mission. This feedback typically aims to improve the system and influences only one final decision authority. The differences in the number of decision makers and the purpose of feedback creates a disconnect between the military's and industry's desire for automated triage.

Captures consistent requirements

The consistency of requirements was not heavily investigated in the surveys. The intent behind this characteristic is to ensure that one requirement does not conflict with another requirement. For change requests, an inconsistency can occur between the proposed change and previous requirement. The specific feedback item of "User assessed negative aspects to the change request" was the only aspect of this characteristic investigated. The full application of the heuristics described in the literature review is best suited for a discussion of technical reviews of change requests, but that aspect was not fully examined.

Program Implementation Specifics

The following sections describe the results from the panel's expanded investigation into two specific characteristics of a good feedback program: clear methodology and capturing complete requirements.

Clear methodology

This characteristic surfaced in Survey 1 and further developed in Survey 2. Panelist Alpha and Delta both stated transparency was an ideal characteristic. Panelist India desired a clear goal and a clear process and Panelist Echo had this observation: "I've been told the process [of providing feedback] is alive, but rarely used because no one understands it." Questions 1-4 of Survey 2 sought to define the exact methodology in relation to this characteristic.

The first four questions of Survey 2 roughly correlated with the four broad steps SWEBOK recommends for software change requests. How to originate the request is tied to Question 1. The review flow was investigated in Question 3. The method and position to make the decision was examined in Question 2. Finally, a way to report the final determination was explored in Question 4. In all, the panel had two areas of constructive consensus: the final decision authority and the best database were both selected. The other two areas—who should initiate a change request and how should the request be reviewed—only had consensus for options not to pursue. The following paragraphs describe each area in detail.

Formal Change Request Originators

In Question 1 the panel did not confirm who should be the proper originators of formal change requests. The panel did have consensus rejecting the utility of both

unfiltered, unsolicited feedback (80%) and feedback only through commanders (70%). The panel was neutral on the utility of channeling feedback through functionals and through current feedback methods such as the feedback methods discussed in literature review. Additionally, two panelists recommended other solutions. Panelist Bravo recommended a panel of experts similar to the Delphi method employed for this research and Panelist Echo recommended the solution was to educate more operators in the current methods for feedback. The demographic breakout of TES panelists meets consensus for all four statements at 75% rejection of unfiltered and commander-only feedback and 75% acceptance of current processes and feedback through a functional chain. The staff demographic is also significant: unanimous rejection of unfiltered feedback.

Change Request Review Process

In Question 3, the panel assessed potential review flows that would filter and vet. From Survey 1 analysis, operators are familiar with the sequential review process of the Form 847. Other comments highlighted two potential routes for review: the Test & Evaluation Squadron and the functional chain inside squadron-level and group-level Weapons & Tactics shops. The group choices are military translations of the OpenProposal group discussions between users, requirements analysts, and engineers.

This question had the least consensus implying future feedback system development should consider the broad range of opinions. Of the ten responses, they were evenly spread out between five choices. The only consensus was the rejection of a group discussion between the operator, the Test & Evaluation squadron and the decision maker. The other selections mainly show individual biases either for a known process or

a fear of an opposing bias. For example, Panelist Charlie was involved in a configuration working group with heavy involvement with the SPO. He selected the group discussion with user, SPO and decision maker. Another example is Panelist Echo, a Weapon School Graduate familiar with the Tactics Improvement Program (TIP). He selected "other" and described a flow similar to the TIP flow: a sequential flow of User→Squadron Weapons & Tactics→Group Weapons & Tactics→MDS-specific weapons school followed by a group discussion between the Weapon School, the TES, the SPO and the decision maker's staff. Panelist Kilo, a TES-experienced panelist, also selected "other" and described an initiative inside the TES to incorporate more operator involvement in Deficiency Reporting through Squadron Weapons & Tactics officers.

The three sequential flows attempt to balance the length of the review chain while balancing any potential bias from sub-cultures. The first flow contains only Weapons & Tactics reviewers who may be biased towards kinetic operations over reconnaissance operations or the administration of takeoff, cruise, and landing operations. The second flow includes TES in the review flow to balance the Weapons & Tactics influence. This flow is slightly longer than the others listed. The third and final sequential flow includes only TES review. As discovered during the surveys, this third flow is currently available; however, it is not well advertised. A major limiting factor is the TES's lack of presence in line squadrons compared to other agencies gathering feedback. Line operators at bases other than Creech AFB—the location of the TES squadron—may only see a single TES member during major upgrade roadshows occurring every few years. Other feedback options include imbedded representatives. The Form 847, AF1067, AFTO22, WEPTAC and TIP feedback programs all have squadron-level shops collecting the initial feedback.

Final Decision Authority For Change Requests

In Question 2, the panel evaluated who should be the final decision authority for change requests and what other entities should influence that decision authority. This area showed the most consensus of any question and largely followed doctrinal premises. 70% of the panel said the Lead MAJCOM commander should be the final decision authority. Of the two panelists selecting a council vote, both selected all MAJCOMs but only one selected COCOMs as having a vote. The final panelist selected the COCOM that has Operational Control (OPCON) over the most number of a particular MDS. For influencing, all the panelists agreed that the lead MAJCOM should either make the decision, be on the council or should influence the final decision. Additionally, the panel had consensus that the TES commander should influence decision. Additional comments from Panelist Kilo align with the entire panel's perception of the TES role: "the role of TES is to represent the operator." Conversely, the panel rejected statements for any COCOM commander or Headquarters Air Force personnel influencing the decision. Comments from Survey 1 indicate the role of COCOMs and HAF is to set the desired mission effect, not the method to attain it. The influence of any commander, including the Weapon School commander, did not reach consensus.

This question had some significant demographic breakouts. All four TES-experienced panelists opposed HAF influence. Additionally, the three staff members were unanimously in favor of any MAJCOM influence and unanimously opposed to HAF or COCOM influence.

Change Request Status Dissemination

In Question 4, the panel assessed the utility of various data architectures and their ability to aid proper communication. The panel had 70% consensus that a "push and pull" database is the appropriate data repository. A "pull" database could be as simple as an online library. The library's owner adds, changes, or deletes information and library users must remember to access the library periodically to check for those updates. In contrast a "push and pull" database allows the former but also sends library users a notification when new or changed information is available; i.e. it pushes the information out to the library users. The user can typically customize settings to only receive certain categories of updates. An example of a custom filter would be an MQ-1 operator looking for notification of any new feedback about the Ground Control Station (a common component between MQ-1 and MQ-9) and the MQ-1 airframe but not the MQ-9 airframe. The utility of a push-and-pull database is to efficiently keep interested parties aware of all available feedback items about a certain subject.

The remaining panelists assessed the best data repository was a "trusted agent" model where only selected trusted users have access to the full reports. Both the current library for Deficiency Reports and Air Force Safety Automated System (AFSAS) only allow access for selected members ("JDRS Homepage," 2015; "AFSAS Help," 2015). One reason for using a trusted agent model is to limit the ability for information to spread beyond the original intent. For AFSAS, this concern is amplified due large portions of "Safety Privilege" information. This concern, however, did not deter the panel from confirming the best solution was not the trusted agent model.

The final option, a pull-only database, was unanimously rejected. While this method is the easiest to implement, it has neither the data protections found in the trusted-agent database nor the ease of communication found in the push-and-pull database.

Capturing complete requirements

Between Question 8 of Survey 1 and Question 5 of Survey 2, the panel first identified then prioritized thirteen individual feedback items that should be included in a change request. These items are listed in Figure 3 in order of their final importance ranking; i.e. lower ranked items assisted communication better than higher ranked items. Consensus for this list was the number of panelists who ranked an individual item within one position of the average ranking. There were only four items that had consensus: attachments, temporary solutions, reviewer comments, and reviewer's information. Attachments and temporary solutions were moderately ranked (6 and 7 out of 13, respectively) and had 70% consensus for both. The consensus means that few panelists considered these items extremely important or unimportant and should be included but not necessarily emphasized on a feedback report. The other two, reviewer comments and information, were consistently ranked at the bottom with 80% consensus for both. The consistent poor ranking means the panel is more interested in having the review (see Question 1) than the information uncovered during the review. This also implies the panel is confident that reviewers will reject inadequate change requests rather than writing comments and passing the change request along. These two items should be relatively minor during feedback.

The lack of consensus for the other nine items is also significant. Essentially these items had large variation among the panel on the relative importance. Fortunately

consensus is not required as the individual items are not mutually exclusive. At a minimum, the relative rank does identify which areas should get the most attention while capturing the feedback.

The staff demographic had significant differences when compared with the entire panel. Specifically the staff valued the proposed solution as the most important (#1) feedback item, up from #4 for the whole panel. Additionally, the staff valued the user's assessment significantly more than the whole panel, ranking it #3 up from #10. Finally, the staff was less concerned about the estimated urgency of the change request, ranking it #11 down from #5. There are no additional comments directly from the panel detailing any motivations for the differences; however, the staff may be more concerned about delineating between what can be done vice what cannot and less concerned about the distinction between the short-term than the long-term timeline.

The TES viewpoint confirmed that the deficiency report process already collects much information while generating change requests. Panelist Kilo included an example Deficiency Report with his survey responses. The survey responses showed some significant overlap and significant differences between the survey responses and the current Deficiency Report.

Table 11 below summarizes the comparison. Of note, the TES squadron is not currently capturing the phase of flight independently from the problem description although the both TES-only demographic and the panel as a whole ranked this item as number 2.

Table 11: Comparison of Deficiency Report and Survey Results

Captured only in the Deficiency Report template	Captured in both Deficiency Reports and the Delphi Survey (# = survey rank)	Captured only in the Delphi Survey (# = survey rank)
Hazard Priority	Sub-system (1)	Phase of Flight (2)
Problem Description	Justification (3)	Estimated Urgency (5)
Known Similar deficiencies	Recommendation / Proposed Solution (4)	Attachments (6)
How was the problem detected	Submitter's information (9)	Temporary solution (7)
Specific version numbers of subsystems		Geographic Area of Operations (8)
		User-accessed feasibility (10)
		User-assessed negative aspects (11)
		Reviewer comments (12)
		Reviewer's information (13)

Summary

This chapter summarized and interpreted the survey responses oriented towards answering two questions: should the Air Force should establish a program to collect unsolicited operator feedback, and if so, how should the program operate. The actual response demographics and metrics detailed the constitution of the panel. The areas of consensus and non-consensus allows for a confirmation of six characteristics and the rejection of an additional characteristic. Finally the panel assessed two specific characteristics in greater detail: clear methodology and capturing complete requirements. The panel was able to meet consensus on just under half of sub-areas required for program implementation. The program implementation consensus areas tie directly to the conclusions and recommendation in the next chapter.

V. Conclusions and Recommendations

Chapter Overview

The Air Force already runs several feedback systems; however no one system meets all the characteristics the panel desired or that were identified in the literature as key characteristics. One current military program (Deficiency Reports) and one commercial tool (Open Proposal) show the most promise for meeting all of the factor characteristics. This research recommends specific improvements to the current system and an application of the tool to another feedback program. Additionally, there are aspects of feedback systems this thesis did not cover and aspects of the whole acquisition system that surfaced while discussing feedback systems. Those two conditions are detailed below as recommended future research.

Conclusions of Research

The research has answered the two investigative questions from Chapter 1: should the Air Force establish an unsolicited-feedback program for line operators, and if so, what should the basic characteristics be? In Chapter 2, selected feedback systems currently in use were compared to literature-generated ideal characteristics. Through the methodology in Chapter 3, the expert panel assessed the characteristics with the results presented in Chapter 4. Below is Table 12, an edited copy of Table 1 only displaying characteristics the panel confirmed.

Table 12: Filtered Summary of Current Feedback System Critiques

	Available to / designed for any line operator	Advertised to all line operators	Focuses on refining current functionality	Captures complete requirements	Clear methodology	Accommodates various feedback mediums	Captures user context/environment	Focuses feedback on actionable subjects	Initiators trust inputs have impact
AF1067	X		p[1]		X	p[2]	p[3]		X
AF847	X	X			X	p[2]	p[3]		X
AFTO 22	X	X			X	p[2]	p[3]		X
JLLIS	X		X				p[3]		
Deficiency Reports	X	p[9]	X	X	X	p[2]	p[3]		p[7]
Cockpit Working Grp	p[9]		X	X			X		X
ARC WEPTAC	p[9]			X	X		X	X	
TIP	p[9]			X	X		X	X	
Sales Representative	X	X	X	p[8]			X	p[8]	
NASA Space Shuttle	X	X	X	X					X
Idavall	X	X	X	X			X	X	X
Contexter	X	*	X			X	X	X	
Open Proposal	X	*	X	X	X	X	X		X
Data mining		*	X						

X=fully meets the characteristic
p=partially meets the characteristic
*=not applicable
p[1] – this method has significant limitations on changing system functionality
p[2] – these methods allow non-video attachments
p[3] – these methods have free text entry areas that may include context if the initiator is aware of the importance of context
p[7] – initiators are typically have database access as they are not line operators
p[8] – most feedback is informal and relies on individual skill-level
p[9] – initiator commonly has informal contact with majority of unit-level operators

The re-scoped summary of current feedback system critiques shows three systems that meet most of the desired characteristics. The OpenProposal tool and Idavall's feedback program are still highly effective programs as discussed at the end of Chapter 2. Idavall's operating construct would be difficult to adapt to the military. Idavall's end-users are the same as the paying customers vice end-users do not make the decisions in the military. Additionally, Idavall's stakeholders are relatively homogenous—a condition not true for the military. Conversely, OpenProposal's strengths and basic design potentially correlate to the concept of the Cockpit Working Group. OpenProposal was designed to focus a group of distinct roles on improving the functionality of a computer's interface. Likewise, the CWG pulls various roles together to improve the design of the aircraft's interface: the cockpit. The third program is the Deficiency Reporting program. This program lacked most of the ideal characteristics the board was unable to confirm; however, it accommodates the vast majority of confirmed characteristics. Evaluating Deficiency Reporting against the desired characteristics shows the program completely or partially meets all the desired characteristics except one. Additionally, Deficiency Reporting process follows many of the specific methodologies confirmed in Survey 2. The recommendations below describe methods to improve current military programs and potential benefits to implementing an adaptation of a commercial method for military feedback.

Significance of Research

This research has identified desired characteristics, some of the basic architecture of a feedback system to collect unsolicited operator feedback, and critiqued several feedback programs. The Air Force has highly trained crewmembers that are

underutilized in the requirements refinement process. While not all of the investigative questions were completely answered, the research identified best practices and highlighted potential changes to current programs that may allow for significant improvements with relatively minor amounts of cost and energy. The inclusion of multiple perspectives broadened and combined the collective knowledge of user-driven feedback methodology in the Air Force. Finally, the research has also highlighted areas where more investigation may be warranted to further improve requirements definition and refinement thereby potentially increasing system effectiveness.

Recommendations for Action

The research generated five specific recommendations. Some of these recommendations involve modifications to publications or technical orders. The first four recommendations deal with specific actions to expand the access, advertisement, and transparency of the deficiency reporting process. The last recommendation is a potential improvement for Cockpit Working Groups.

The first recommendation stems from the concept of both focusing feedback and capturing the context around a change request: add "phase of flight" to the standard deficiency report template. The two goals bound the proper amount of selectable phases on both ends. Limiting the available phases to "Launch and Recover Element (LRE)" and Mission Control Element (MCE)" does not truly capture the context—the MCE environment covers all phases except terminal phase of flight and is, therefore, overly broad. Conversely, listing every possible phase of flight creates a list too long to be reasonably remembered and does not focus the feedback to specific areas. The author recommends the following phases: ground operations, takeoff, departure, enroute,

mission, arrival, and landing. Additionally, the mission phase can be separated into specific mission types; i.e. reconnaissance, surface attack tactics, Time-Sensitive Target (TST) attack, Strike Coordination and Reconnaissance (SCAR), Close Air Support (CAS) or Combat Search and Rescue (CSAR). The panel confirmed the relative importance of this particular feedback item during Survey 2.

The next three recommendations aim to increase the transparency of and operator involvement in the DR process. The first of these is semantic in nature: add an explicit definition of a deficiency to AFI 99-103 and TO 00-35D-54. Both of those regulations dictate procedures for categorizing and processing deficiencies but neither explicitly defines them. Lack of a clear definition shrouds the scope of the DR process in uncertainty and allows for operator to misperceive limits on the DR program. Combining the definitions for the distinct types of deficiencies implies a deficiency is any material or design condition that is unsafe or limits the use of the material for the purpose intended due to material defect, design defects, or specification inadequacy (TO 00-35D-54, 2011:C5). Deficiencies should also include design enhancements that complement or improve mission suitability or effectiveness even if incorporating the enhancement is not absolutely required for successful mission accomplishment.

Culturally at least one member of the TES squadron considered the OT&E squadron as the "voice of the operator" when dealing with other acquisition stakeholders. Formally capturing in doctrine that role could expand the coverage of the operator's viewpoint for all current feedback methods involving OT&E. Specifically, AFI 99-103 should require the general T&E community to expand the responsibilities from "provide information to users" to also include "educate on current feedback methods" and "seek

operator's engagement in product improvement" (AFI 99-103, 2013:7). More specifically, this responsibility is most appropriate for the Operational T&E elements and should be clearly stated as such (AFI 99-103, 2013:29). Additionally the rate of success for reaching and engaging operators is a metric worth tracking. Specifically the percentage of DRs originating with a line operator should be added to the TO 00-35D-54 required metrics under the topic of "Warfighter Satisfaction" (TO 00-35D-54, 2011:A1).

The last recommendation for increasing access and transparency is to allow operators access to the database library for DRs, specifically Joint Deficiency Reporting System (JDRS) (AFI 99-103, 2013:58). For sake of need-to-know, the access can be read-only except for deficiency submissions and limited to the operator's MDS and any shared major components such as a common engine or munition. A key characteristic for upgrading this library is the automated push of information to the user when certain criteria are met. For example, an operator may only be interested in deficiencies related to mission tasks for the MQ-1. An automated email could alert that individual operator when a DR with those criteria changes status. This characteristic is also useful for current users of JDRS. For example, a contractor may only need to know about DRs related to a particular sub-system. Rather than requiring manually checking for updated reports, an automated system would save the contractor significant time and energy.

The final recommendation is to incorporate OpenProposal, or a similar tool based on its strengths, for the Cockpit Working Group. The CWG's intent is to evaluate and improve the operational suitability and effectiveness of an aircraft's cockpit or remote operator station (AFI 63-112, 2011:para 2.1). Likewise, OpenProposal's main intent is to capture desired interface changes then facilitate a meaningful discussion between

stakeholders about the proposed change (Rashid, 2007:372). The electronic discussion via OpenProsoal potentially increases the frequency of communication, decreases the personal effort to submit feedback, mitigates the geographic dispersion of the CWG members, or increases the maximum amount of involved operators.

Potential Future Research

There are a few recommendations for future research based on some findings and limitations of this thesis. The limitations revolve around perspectives that were either de-scoped or unavailable. Other areas of future research relate to answers to open-ended questions that were tangential to this study but could improve the acquisition system in other areas.

Limitations

This study had significant coverage for the operator, TES, and staff perspectives. Other perspectives were either not covered or were not covered to the same depth. The first lacking perspective is the Weapon School. Two weapon school graduates accepted the study invitation and while both responded to the first survey, only one responded to the second. The reduced amount of representation is significant as WPS graduates are more likely to have experienced the true upper bounds on an MDS's mission effectiveness and suitability. Additionally, WPS graduates tend to populate leadership positions, therefore the WPS has a concentration of influence compared to the Air Force writ large. Future research with WPS graduates could investigate whether removing materiel feedback from WEPTACs negatively impacted WPS graduates ability to affect meaningful changes to airframes. Research in this area should determine if current systems are adequate to capture the concerns of this key demographic.

Another perspective was the SPO: two SPO members accepted the invitation, but only one responded to the first survey and neither responded to the second. Additionally a line unit's SPO liaison was not available for the second survey. The SPO is significant as a system's Program Manager is responsible for large portions of the acquisition process including significant roles in both the DR program and the CWG. Systemic changes to the acquisition process require understanding the role of the SPO. Specific research could determine if operator feedback from current programs is adequate to properly communicate the needs of the community. If areas of weakness exist, research could also determine solutions to increase the quality of the feedback.

The study was deliberately scoped to only conventional staff members—for RPA aircraft this was Air Combat Command. This scope focused the panel towards the processes of conventional acquisition through the lead command rather than special or unconventional acquisition. Those other organizations have access to separate funding which further complicates an already complicated subject area. With initial research complete, an expanded research effort should include the other organizations. Specific research questions could determine if unconventional units use additional undocumented methods for feedback and, if they exist, should those methods be applied to conventional forces as well.

The last limitation has less impact than the three above: the focus on RPA aircraft compared to manned aircraft. This limitation is less significant as the RPA community is less mature than most manned aircraft. The current construct for RPA is merely 20 years old, starting in April of 1996 when the Secretary of Defense selected the Air Force to operate the RQ-1 Predator ("MQ-1B Fact Sheet," 2010). Most other communities—

fighters, bombers, airlift, refueling, etc—have significantly more experience. Additional studies could determine if different feedback program characteristics are desirable for other communities. The research could analyze differences based on airframe maturity, mission maturity, or tactical vice non-tactical airframes.

These limitations should be further investigated to ensure complete understanding of how to collect user feedback from a variety of communities. Without additional research, leadership for distinct communities may not be applying the most effective feedback tools. Properly defined requirements may assist in an overall improvement of the acquisitions process.

Tangential Concerns From the Panel

A significant concern from Panelist Hotel, a staff member, was the lack of availability for experts to advise other stakeholders on the requirements. He stated the true experts were not typically available and the designated representative is not always an expert in the system. The lack of expertise is potentially due to leadership viewing an assignment as liaison as less prestigious than competing assignments for career progression. Additional research could determine if that condition exists, and if so, how the condition should change to ensure staff agencies have proper operator representation.

Another major concern from the panel is the overall timeliness of the acquisition system. Just over half (7 of 13) of first survey respondents stated that "timely" is desired characteristic for feedback systems. This desire is likely to also apply to the entire acquisition system. A study dedicated to determining a prioritized list of characteristics for the entire acquisition system from the operator viewpoint could determine what aspects of the acquisition system have the most impact to the operator. If timeliness is

confirmed as a broadly desired characteristic, additional studies can further identify causes and fixes for the untimely portions of the acquisition process.

Summary

The chapter above reviewed the current feedback systems as compared to the characteristics the panel confirmed as significant. This comparison revealed that Deficiency Reporting meets many of the characteristics but could be improved to meet all of them. Additionally, the OpenProposal tool also most of the desired characteristics and might improve the CWG if implemented in that program. Finally, recommended future research focused on other acquisition concerns from the panel and perspectives not covered in the panel.

Appendix A: Glossary

Acronyms

ACC	Air Combat Command
AETC	Air Education and Training Command
AF	Air Force or Air Force (Form)
AFFSA	Air Force Flight Standards Agency
AFI	Air Force Instruction
AFRL	Air Force Research Labs
AFSAS	Air Force Safety Automated System
AFTO	Air Force Technical Order
AI	Air Interdiction
ARC	Air Reserve Component
ASRC	Air Systems Requirements Council
CAF	Combat Air Forces
CAS	Close Air Support
CGA	Capability Gap Assessment
COCOM	Combatant Commands
CONPLANS	Concept Plans
CSAR	Combat Search and Rescue
CWG	Cockpit Working Group
DARPA	Defense Advanced Research Projects Agency
DoD	Department of Defense
DR	Deficiency Report
DT&E	Developmental Test and Evaluation
FFRDC	Federally Funded Research and Development Center
GCS	Ground Control Station
GPS	Global Positioning System
GUI	Graphical User Interface
HAF	Headquarters Air Force
HQ	Headquarters
JCIDS	Joint Capabilities Integration and Development System
JDRS	Joint Deficiency Reporting System
JLLP	Joint Lessons Learned Program
JLLIS	Joint Lessons Learned Information System
JUON	Joint Urgent Operational Needs
LRE	Launch and Recovery Element
MAJCOM	Major Command
MCE	Mission Control Element
MDS	Major Design Series

NASA	National Air and Space Administration
NAF	Numbered Air Force
OPCON	Operational Control
OPLANS	Operation Plans
OPR	Office of Primary Responsibility
OT&E	Operational Test and Evaluation
PACAF	Pacific Air Force
POC	Point of Contact
RPA	Remotely Piloted Aircraft
SAB	Scientific Advisory Board
SCAR	Strike Coordination and Reconnaissance
SPO	System Program Office
SRD	System Requirements Document
SWEBOK	SoftWare Engineering Body of Knowledge
TES	Test and Evaluation Squadron
TIP	Tactics Improvement Proposal
TO	Technical Order
TRB	Training Review Board
TST	Time-Sensitive Target
TSgt	Technical Sergeant
USAFE	United States Air Forces Europe
UON	Urgent Operational Need
WEPTAC	Weapons and Tactics Conference
WEZ	Weapons Engagement Zone
WPS	Weapons School (Squadron)

Terms

Ground Control Station (GCS)	The GCS is the cockpit for a remotely piloted aircraft.
Launch & Recovery Element (LRE)	Current technology allows crews to control remotely piloted aircraft from any global location for all phases of flight except for ground operations, takeoff, and landing. The LRE crew links to RPA aircraft using line-of-sight transmitters for the express purpose of launch and recovery. LRE crews must operate from the same airfield as the aircraft. See Mission Control Element.
Mission Control Element (MCE)	Current technology allows crews to control remotely piloted aircraft from any global location

	for most phases of flight. MCE crews fly aircraft via satellite link to complete the assigned mission. MCE crews may be stationed at any location with enough communication architecture. See Launch and Recovery Element.
Remotely Piloted Aircraft (RPA)	One of many terms used to describe an aircraft whose crew is not inside the aircraft. It is subset of Unmanned Aerial Vehicles to specify constant man-in-the-loop architecture. Colloquially it describes MQ-1 and MQ-9 aircraft.
Weapons School (WPS)	The Air Force Weapons School is a 6-month graduate-level course in tactically executing airpower. The Weapons School is regarded as the pinnacle of tactical prowess and is often the hub of emerging tactics for the Combat Air Force.

Appendix B: Initial Questionnaire

Delphi Study on User Feedback Mechanisms For Materiel Solutions

Thank you for participating in this research. I appreciate your time and candid responses. The purpose of this effort is to define the characteristics of an effective user feedback system to modify materiel solutions, if such a system exists. The research will take place in several rounds, with each of the participants provided an opportunity to respond to a series of questions. After each round, the researcher will aggregate individual responses into a coherent whole and then send out to the group a refined series of questions and an instrument to assess the group responses from the previous round. The end goal is to reach consensus on the group's assessment of the topic.

1. Please complete this instrument and return it electronically no later than **15 May 2015**.

2. There are 8 questions. This questionnaire is "non-attribution," so please elaborate fully on your answers. Please do not collaborate with other individuals in providing your answers. Once all responses are received, you will be given the opportunity to revise your initial responses to questions in part 2. Subsequent rounds will be announced as needed and all research will conclude by 1 August 2015.

Part 1: Basic Demographics

1. Personal information
    a. Level of education
    b. Current job title
    c. Most recent qualification
2. If applicable, how many total years have you flown in an operational flying squadron (BMC or CMR status) and with which group (27 SOG, 49 OG, 432AEG, 732AEG, etc)?
3. In what capacities have you dealt with the acquisition system?

Part 2: This research pertains to the definition of an effective feedback system for users to address materiel changes (software or hardware). Please answer and elaborate on the following:

If responses include FOUO information please mark and transmit appropriately.

4. Imagine that an Air Force system or Major Design Series (MDS) has recently reached IOC and is now used operationally. What stakeholders (individual job positions or communities of people) should have power to change the system to be more effective in future operations and why? Please list in priority order and include any discussion or justification you feel necessary.
5. What is your personal view on the proper role of end-users or line operators in the system modification or upgrade process?
6. If you could change one thing about the methods or process used to determine a system's requirements inside the DoD what would it be?
7. What are your top 2 or 3 preferred characteristics of any feedback system?
8. What type of information should any feedback system seek to capture?

Please note the following:

1. Benefits and risks: There are no personal benefits or risks for participating in this research. Your participation should take less than 30 minutes per round.

2. Voluntary consent: Your participation is completely voluntary. You have the right to decline to answer any question, as well as refuse to participate in this study or to withdraw at any time. Your decision of whether or not to participate will not result in any penalty or loss of benefits to which you are otherwise entitled. Completion of the questionnaire implies your consent to participate.

3. Confidentiality: Your responses are completely confidential, and your identity will only be used by the researchers during the data gathering and interpretation phase of the research. No individual data will be reported; only data in aggregate will be made public. Individual data will safeguarded under AFI 33-332 rules for FOUO data regardless of whether FOUO data is actually recorded. If you have any questions or concerns about your participation in this study, please contact:

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   Assistant Professor of Systems Engineering
   Graduate School of Engineering and Management
   Air Force Institute of Technology
   Wright-Patterson AFB, OH
   Voice: 937-255-3636 (785-3636 DSN) ext 7402

Privacy Act of 1974 and AFI 33-332

The Material / Information contained herein falls within the purview of the Privacy Act of 1974 and will be safeguarded in accordance with the applicable system of records notice and AFI 33-332. This study is anonymous. No attempt to identify you or your organization will be made unless information indicates a credible or potential threat. By participating in this research, you acknowledge that the information you provide, including the open text comments, may be viewed and released in accordance with the Freedom of Information Act. Do not include personal identifying information.

Operational Security (OPSEC), AFI 10-701

Do not provide OPSEC information. OPSEC is a process of identifying, analyzing and controlling critical information indicating friendly actions associated with military operations and other activities such as: 1) Identify those actions that can be observed by adversary intelligence systems; 2) Determine what specific indications could be collected, analyzed, and interpreted to derive critical information in time to be useful to adversaries; and 3) Select and execute measures that eliminate or reduce to an acceptable level the vulnerabilities of friendly actions to adversary exploitation. Comply with all OPSEC measures outlined in AFI 10-701. Do not provide critical information or indicators.

Please respond to this request for your assessment **electronically** and return it to: joseph.goldsmith@us.af.mil. If you have questions on any of this, I can also be reached at (575) 572-8128 (work), 572-8128 (DSN), or 702-862-0718 (cell). Written correspondence can be addressed to:

Maj Joseph Goldsmith
490 1st St
Bldg 29, Rm 1202
Holloman AFB, NM 88330

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ THE INFORMATION PROVIDED ABOVE.

Volunteer Signature_____Date_____

Volunteer Name (printed)_____

Appendix C: Second and Final Questionnaire

Delphi Study on User Feedback Mechanisms For Materiel Solutions – Survey 2

Thank you for participating in this research. I appreciate your time and candid responses. The purpose of this effort is to define the characteristics of an effective user feedback system to modify materiel solutions, if such a system exists. The research will take place over a few rounds, with each of the participants provided an opportunity to respond to a series of questions. After each round, the researcher will aggregate individual responses into a coherent whole and then send out to the group a refined series of questions and an instrument to assess the group responses from the previous round. The end goal is to reach consensus on the group's assessment of the topic.

1. Please complete this instrument and return it electronically no later than **26 June 2015**.

2. There are 5 questions. This questionnaire is "non-attribution," so please elaborate fully on your answers. Please do not collaborate with other individuals in providing your answers. Subsequent rounds will be announced as needed and all research will conclude by 1 August 2015. You will be notified when the research is terminated.

Questions:

1. User involvement

Virtually all surveys indicated users should be involved in change requests to some degree. What user types of user involvement should be accepted?

Check all that apply:

☐ Unfiltered, unsolicited user feedback
☐ Unsolicited user feedback, vetted only through commanders (SQ/cc or higher)
☐ Unsolicited user feedback, vetted through a functional chain (i.e. not commanders)
☐ User feedback through formal studies or currently established feedback systems (such as Deficiency Reports, Joint Lesson Learned Library, Safety Boards, and Form 1067 submissions; note: WEPTACs no longer accept materiel feedback)
☐ Other_____

2. Final determination

Who should be the final approval authority for change requests? Assume the commander in question may delegate authority to a lower staff member for minor change requests.

◯ 1. The lead MAJCOM
◯ 2. The COCOM that has OPCON over the most number of a particular MDS
◯ 3. By council vote (mark the appropriate voting members):
  ☐ The lead MAJCOM
  ☐ Any MAJCOM that owns any assets
  ☐ The COCOM with the most OPCON'd assets
  ☐ Any COCOM with the asset in a war plan

Many responses indicated that decisions should not be made in a vacuum and other stakeholders should be able to influence the final decision on change requests. Who of the following should have influence or give suggestions about the change request? Check all that apply.

- ☐ Headquarters AF
- ☐ The lead MAJCOM
- ☐ Any MAJCOM that owns any assets
- ☐ The COCOM with the most OPCON'd assets
- ☐ Any COCOM with the asset in a war plan
- ☐ Applicable weapons school commander
- ☐ Applicable TES commander
- ☐ Any commander (Sq/cc or higher)

3. Vetting Process

Several responses indicated the need to filter feedback. The most common Air Force method is to have a functional chain of command sequentially review submissions. For example, the Form 847 is sequentially processed from the user to Squadron Standardization/Evaluation to Group Stan/Eval to NAF Stan/Eval to MAJCOM Stan/Eval. In contrast, a prominent commercial feedback model uses a group discussion between the user, requirements analysts, and engineers to fully capture the requirement.

Which of the following proposed methods would BEST facilitate timely and complete reviews of submissions?

- ○ Sequential flow: User→Squadron Weapons and Tactics→Group Weapons and Tactics→decision maker
- ○ Sequential flow: User→ Squadron Weapons and Tactics→Group Weapons and Tactics →Operational Test&Eval Squadron→decision maker
- ○ Sequential flow: User→ Operational Test&Eval Squadron→decision maker (note: this flow is similar to the current construct for Deficiency Reports)
- ○ Sequential flow: Other_____
- ○ Group discussion with user, SPO, decision maker's staff
- ○ Group discussion with user, TES, decision maker's staff
- ○ Group discussion with _____

4. Non-functional characteristics

About half of the responses indicated the feedback program should have good communication. Which of the following common architectures of data repositories would BEST assist good communication without sacrificing timeliness or inducing waste by excess communication?

- ○ An open-access online library where interested individuals can seek out and read submitted change requests; i.e. a pull system where the individual must pull the data they want.
- ○ An open-access online library with automated notifications where individuals can both seek out submitted change requests and be notified when change requests meeting certain criteria change status; i.e. a push and a pull system where the system will push data or the individual can pull the data.
- ○ A limited-access online library where only trusted agents (i.e. those people involved in processing the change requests) have access. Other individuals, such as a line operator, must request the data from the trusted agent.
- ○ Other _____

5. *Specific feedback items*

If a feedback program were to exist, it should effectively communicate the change request and the complete context around the request. Rank order the following potential items based on their ability to support communication.

13 _Phase of flight (e.g. launch/recovery, cruise, recon mission, strike mission, etc)
13 _Geographic area(s) with the most impact from this change request
13 _MDS sub-system under request
13 _Proposed solution
13 _Attachments to support videos, pictures, or other non-textual feedback
13 _If applicable, acceptable short-term fix or alternate solutions
13 _If applicable, estimated urgency (i.e. time before the request is no longer needed / overcome by events)
13 _Justification: i.e. impact to the crew or mission if not implemented
13 _User assessed negative aspects to the change request
13 _User assessed feasibility analysis
13 _User information (name, rank, crew position, qualification, contact details)
13 _Reviewer comments
13 _Reviewer information (name, rank, crew position, qualification, contact details)

6. *Open Comments*

If you have any amplifying comments or justifications for ANY of the above questions, please add them here.

If responses include FOUO information please mark and transmit appropriately.

Please note the following:

1. Benefits and risks: There are no personal benefits or risks for participating in this research. Your participation should take less than 30 minutes per round.

2. Voluntary consent: Your participation is completely voluntary. You have the right to decline to answer any question, as well as refuse to participate in this study or to withdraw at any time. Your decision of whether or not to participate will not result in any penalty or loss of benefits to which you are otherwise entitled. Completion of the questionnaire implies your consent to participate.

3. Confidentiality: Your responses are completely confidential, and your identity will only be used by the researchers during the data gathering and interpretation phase of the research. No individual data will be reported; only data in aggregate will be made public. Individual data will safeguarded under AFI 33-332 rules for FOUO data regardless of whether FOUO data is actually recorded. If you have any questions or concerns about your participation in this study, please contact:

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   Air Force Institute of Technology
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Privacy Act of 1974 and AFI 33-332

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Operational Security (OPSEC), AFI 10-701

Do not provide OPSEC information. OPSEC is a process of identifying, analyzing and controlling critical information indicating friendly actions associated with military operations and other activities such as: 1) Identify those actions that can be observed by adversary intelligence systems; 2) Determine what specific indications could be collected, analyzed, and interpreted to derive critical information in time to be useful to adversaries; and 3) Select and execute measures that eliminate or reduce to an acceptable level the vulnerabilities of friendly actions to adversary exploitation. Comply with all OPSEC measures outlined in AFI 10-701. Do not provide critical information or indicators.

Please respond to this request for your assessment **electronically** and return it to: joseph.goldsmith@us.af.mil. If you have questions on any of this, I can also be reached at (575) 572-8128 (work), 572-8128 (DSN), or 702-862-0718 (cell). Written correspondence can be addressed to:

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Internal Use Field

Appendix D: Air Force Form 847

ATTACH EXTRACT

RECOMMENDATION FOR CHANGE OF PUBLICATION

1. DATE	2. UNIT/AFSAS CONTROL NO.	3. MAJCOM/HHQCONTROL NO.	4. PUBLICATION NUMBER	5. EMERGENCY OR SAFETY INCIDENT RELATED ☐ YES ☐ NO
6. PUBLICATION NAME			7. BASIC DATE OF PUBLICATION	8. REVISION/CHANGE DATE
9. PAGE NUMBER	10. MAJOR/SUB PARAGRAPH TITLE/NUMBER OR FIGURE NUMBER			
11. ITEM NUMBER	12. OPR *(for instructions)*	13. IS SUPPORTING DOCUMENTATION ATTACHED ☐ YES ☐ NO	14. SERIES AFFECTED *(for flight manuals)* ☐ YES ☐ NO	

15. TEXT OR FIGURE AS PRESENTLY READS *(List what is considered to be incorrect or missing):*

16. CHANGE TO READ *(Describe the desired change)*

17. RATIONALE *(Provide reason or additional comments for this recommendation)*

18. NAME/RANK *(of originator)*	19. SIGNATURE	
20. ORGANIZATION	21. DSN	FAX
22. FULL MAILING ADDRESS		23. E-MAIL

AF FORM 847, 20090922

TO:	FROM: *(Full Address Including Zip Code and DSN)*

SECTION 1 ☐ CONCUR	☐ CONCUR WITH INTENT	☐ DO NOT CONCUR
REMARKS		

DATE	TYPED NAME, GRADE, AND TITLE	SIGNATURE

TO	FROM

SECTION 2 ☐ CONCUR	☐ CONCUR WITH INTENT	☐ DO NOT CONCUR
REMARKS		

DATE	TYPED NAME, GRADE, AND TITLE	SIGNATURE

TO	FROM

SECTION 3 ☐ CONCUR	☐ CONCUR WITH INTENT	☐ DO NOT CONCUR
REMARKS		

LEAD MAJCOM	COPIES FORWARDED TO

DATE	TYPED NAME, GRADE, AND TITLE	SIGNATURE

TO *(FMM/Final Approval Authority)*	FROM *((Full Address Including Zip Code and DSN)*

SECTION 4

☐ CONCUR ☐ FORWARDED TO _____ FOR REVIEW AND/OR ACTION

☐ CONCUR WITH INTENT ☐ DO NOT CONCUR *(See comments below)*

REMARKS

DATE	APPROVAL/DISAPPROVAL AUTHORITY NAME, GRADE & TITLE	SIGNATURE

AF FORM 847, 20090922

Appendix E: Air Force Form 1067

PAGE 1 OF

MODIFICATION PROPOSAL

PART I - REQUEST FOR ACTION		DATE:
1. INITIATOR	2. INITIATOR'S POC ORGANIZATION	3. USING COMMAND HQ POINT OF CONTACT
4. TITLE:		
5. ORGANIZATION CONTROL NUMBER	6. OTHER NUMBERS	
7. AFFECTED CONFIGURED ITEM/SYSTEM:		
A. MDS/TMS/CEIL/CPIN	B. WUC	C. NSN
D. SRD CODE	E. NOUN	F. OTHER
8. PURPOSE *(State the need or deficiency to be corrected. Include expected results.)*		
9. IMPACT *(Urgency of need and impact if not satisfied.)*		
10. CONSTRAINTS/ASSUMPTIONS/PROPOSED SOLUTIONS		
11. ORGANIZATION VALIDATION		DATE RECEIVED:
☐ A. PROPOSED REQUEST IS VALIDATED AS AN ORGANIZATION NEED/REQUIREMENT WHICH REQUIRES ACTION.		
☐ B. PROPOSED REQUEST IS DISAPPROVED AND IS NOT AN ORGANIZATION NEED/REQUIREMENT WHICH REQUIRES ACTION.		
☐ C. PROPOSED REQUEST IS RETURNED TO SUBMITTER FOR ADDITIONAL INFORMATION.		
D. DATE	E. NAME, GRADE, TITLE, and DSN *(Type or Print)*	F. SIGNATURE

AF FORM 1067, 19991101, V2 PREVIOUS EDITIONS ARE OBSOLETE.

PART II - USING COMMAND VALIDATION | DATE RECEIVED:

12. USING COMMAND VALIDATION

☐ A. PROPOSED REQUEST IS VALIDATED AS AN ORGANIZATION NEED/REQUIREMENT WHICH REQUIRES ACTION.

☐ B. PROPOSED REQUEST IS DISAPPROVED AND IS NOT AN ORGANIZATION NEED/REQUIREMENT WHICH REQUIRES ACTION.

☐ C. PROPOSED REQUEST IS RETURNED TO SUBMITTER FOR ADDITIONAL INFORMATION.

☐ D. FORWARD TO LEAD COMMAND | E. USING COMMAND CONTROL NO.

F. DATE	G. NAME, GRADE, TITLE, and DSN *(Type or Print)*	H. SIGNATURE

PART III - LEAD COMMAND VALIDATION | DATE RECEIVED:

13. LEAD COMMAND ACTION OFFICER	14. THRU *(Optional Routing)*	15. SINGLE MANAGER OFFICE

16. MODIFICATION TYPE ☐ T-1 ☐ T-2 ☐ PERMANENT (P) ☐ P(S)-SAFETY | 17. LEAD COMMAND CONTROL NO.

18. LEAD COMMAND REMARKS *(Identify any constraints or assumptions)*

19. LEAD COMMAND VALIDATION

☐ A. VALIDATED REQUEST ☐ B. DISAPPROVED

20. NAME, GRADE, TITLE, AND DSN *(Type or Print)*	21. SIGNATURE	22. DATE

PART IV - SINGLE MANAGER REVIEW AND APPROVAL | DATE RECEIVED:

23. SM ACTION OFFICER	24. CENTER CONTROL NUMBERS	25. TOTAL BP/EEIC:			
	A. CENTER MIP NO:	Type Funds	Amount	Type Funds	Amount
	B. ECP NO:				
	C. TCTO NO:				

26. NR OF CIS AFFECTED: | 27. TOTAL KITS NEEDED:

28. ALSO AFFECTS: ☐ SUPPORT EQUIP ☐ AIRCREW TRAINING ☐ TRAINING DEVICES/VISUAL AIDS *(Maint)* ☐ TECH DATA ☐ SPARES ☐ SOFTWARE ☐ OTHER *(Identify)*

29. KIT OR UNIT COST	30. TOTAL COST	31. LEAD TIME	32. INSTALLATION *(Begin)* *(Completed)*

33. LEVEL OF ACCOMPLISHMENT. ☐ USER ☐ DEPOT ☐ BOTH ☐ OTHER

34. USER WORK HOURS	35. DEPOT WORK HOURS:	36. TOTAL WORK HOURS:

37. MANUFACTURER: | 38. AIRCRAFT BREAKOUT:

39. ENGINEERING REVIEW RECOMMENDATION *(S)*

☐ APPROVED ☐ DISAPPROVED *(See attached remarks)*

40. NAME, GRADE, TITLE, AND DSN *(Type or Print)*	41. SIGNATURE	42. DATE

PART V - LEAD COMMAND CERTIFICATION/APPROVAL

☐ TEMPORARY MOD APPROVED ☐ PERMANENT MOD APPROVED *(Proceed to Budgeting)*

☐ MOD DISAPPROVED ☐ MNS/ORD TO BE DEVELOPED

43. NAME, GRADE, TITLE, AND DSN *(Type or Print)*	44. SIGNATURE	45. DATE

AF FORM 1067, 19991101, V2 *(REVERSE)*

Appendix F: Air Force Technical Order Form 22

TECHNICAL MANUAL (TM) CHANGE RECOMMENDATION AND REPLY (Use IAW Completion Instructions and TO 00-5-1)		LCN	OMB NO. 0704-0188
1. PIM *(or equivalent)* ORGANIZATION NAME PHONE INITIAL SUBMIT DATE ☐ APPROVED ☐ DISAPPROVED E-MAIL Click to sign	2. MAJCOM CCP *(After Review, Return to PIM)* ORGANIZATION NAME PHONE REVIEW DATE ☐ APPROVED ☐ DISAPPROVED E-MAIL Click to sign		
3. LEAD COMMAND CCP *(After Review, Return to PIM)* ORGANIZATION NAME PHONE REVIEW DATE ☐ APPROVED ☐ DISAPPROVED E-MAIL Click to sign	4. TO MANAGEMENT ACTIVITY *(After Receipt, Forward to Evaluator)* ORGANIZATION NAME PHONE RECEIPT DATE E-MAIL Click to sign		
5. LOCAL CONTROL NUMBER (LCN)	6. PRIORITY *(Check One)* ☐ EMERGENCY ☐ URGENT ☐ ROUTINE	7. CHANGE TYPE *(Check One)* ☐ CORRECTION ☐ IMPROVEMENT	
8. INITIATOR NAME RANK PHONE DATE E-MAIL Click to sign	9. INITIATOR SUPERVISOR NAME RANK PHONE DATE E-MAIL Click to sign		
10. PUBLICATION NUMBER	11. BASIC DATE	12. CHANGE NUMBER	13. CHANGE DATE
14. WORK PACKAGE/WORK CARD ID	15. PAGE NUMBER	16. PARAGRAPH NUMBER	17. FIGURE/TABLE NUMBER
18. SHORT DESCRIPTION OF DEFICIENCY			
19. DEFICIENCY			

AFTO FORM 22, 20140331 **PREVIOUS EDITION IS OBSOLETE**

LCN:

20. RECOMMENDED TM CHANGE

21. SAVINGS/YR - DOLLARS	22. SAVINGS/YR-MANHOURS

23. EVALUATOR *(After evaluation, forward to supervisor)*	24. EVALUATOR/SUPERVISOR *(After review, return to TO Management Activity)*
NAME	NAME
RANK PHONE	RANK PHONE REVIEW DATE
RECEIPT DATE EVALUATION DATE	E-MAIL
E-MAIL	Click to sign
Click to sign	

25. DISPOSITION

- ☐ APPROVED
- ☐ DEFERRED
- ☐ ABEYANCE
- ☐ ADVISEMENT
- ☐ DUPLICATE
- ☐ DISAPPROVED
- ☐ OTHER

26. DISPOSITION/REMARKS

VERIFICATION REQUIRED BY ☐ PERFORMANCE ☐ DESK-TOP ANALYSIS

27. IDEA BENEFITS ARE ☐ INTANGIBLE ☐ TANGIBLE - AMOUNT

28. CONTINUATION

AFTO FORM 22, 20140331

ROLE	AFTO 22 ABBREVIATED COMPLETION INSTRUCTIONS*
WUC/LCN	WUC or LCN if applicable.
INITIATOR (Block 8)	• Complete blocks 6-7 and 10-20. Complete blocks 21, 22 and 27, if applicable. • Complete block 8 and digitally sign. Forward signed form and any required attachments to supervisor
Initiator Supervisor (Block 9)	• Review blocks 6-7, 10-22 and 27 for validity, accuracy and completeness. Make necessary changes and enter corresponding comments in block 28. • Complete block 9, and digitally sign • Forward signed form and all attachments to PIM (or equivalent).
PIM (or Equivalent) (Block 1)	• Review blocks 6-7, 10-22 and 27 for validity, accuracy and completeness. Make appropriate changes and enter corresponding comments in block 28 • Enter Local Control Number in block 5. • Enter organization information and e-mail address (preferably an organizational e-mail) into block 1, 2, and 3. • See routing information, via AFNET at https://cs3.eis.af.mil/sites/00-TO-00-59/default.aspx • Enter the Initial Submit Date and digitally sign block 1 • Forward signed form, and all attachments, to the first reviewer • Enter dates of subsequent reviews in block 28. • Forward to the TO Management Activity in block 4. Note: Follow up with reviewers if RC is not returned within 14 calendar days of submission. Follow up with the evaluator if a disposition is not received within 48 hours for an
MAJCOM and Lead Command CCP Reviewer (Blocks 2 and 3)	• Review blocks 6-7, 10-22 and 27 for validity, accuracy and completeness. Make appropriate changes and enter comments in block 28 • Complete block 2 or 3, as appropriate, including review date. Digitally sign • Returned signed form, and all attachments, to PIM (or equivalent) (block 1)
TO Management Activity (Block 4)	• Complete block 4 and digitally sign • Forward signed form, and all attachments, to evaluator (block 23) • Upon return of completed form from evaluator/evaluator supervisor, return to PIM
Evaluator (Block 23)	• Enter receipt date in block 23 • Review blocks 6, 7, 10-22, and 27 for validity, accuracy and completeness. Make appropriate changes and enter corresponding comments in block 28 • Change type (block 7) will not be changed without the approval of the submitting MAJCOM CCP • Recommended disposition in block 25 • Provide appropriate verification and disposition remarks in block 26 • Complete block 23, including entering evaluation date, and digitally sign • Forward completed form and all attachments, to supervisor
Evaluator Supervisor (Block 24)	• Review recommended disposition, complete block 24 and digitally sign. • This authority may be delegated to the evaluator. If so delegated, document in block 28, along with the first level supervisor's name and e-mail address. • Return completed form to TO Management Activity (Block 4)

*** FOR AFTO FORM 22 DETAILED COMPLETION INSTRUCTIONS, SEE TO 00-5-1**

AFTO FORM 22, 20140331

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Vita

Major Joseph Goldsmith has flown his entire career in an operational capacity. Over the last eleven years, he has accumulated 270 hours in the F-15C Eagle and over 2,000 hours in the MQ-1 Predator. Operational experience includes Operation Iraqi Freedom, Operation Enduring Freedom, and other undisclosed operations. Primary duties cover a range of roles including Squadron Chief of Combat Systems, Squadron Chief of Weapons, Group Standardization and Evaluation Branch Chief, and Wing Director of Exercises. Academically he was awarded a Bachelor of Science in Aeronautical Engineering from the United States Air Force Academy and is pursuing a Distance Learning Masters of Systems Engineering from the Air Force Institute of Technology.

REPORT DOCUMENTATION PAGE		*Form Approved* *OMB No. 0704–0188*

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Collecting Unsolicited User-Generated Change Requests	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Goldsmith, Joseph W, Maj, USAF	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Institute of Technology Graduate School of Engineering and Management (EN) 2950 Hobson Way Wright-Patterson AFB, OH 45433-7765	8. PERFORMING ORGANIZATION REPORT NUMBER AFIT-ENV-MS-15-D-002
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	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

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This work is declared a work of the U.S. Government and is not subject to copyright protection in the United States.

14. ABSTRACT
Unlike aircrew directly associated with acquisitions, line operators are not fully engaged in the methods to push materiel—hardware or software—change requests up the chain, to a decision maker, and then to the engineers. The Air Force trains these end users to logically apply expert systems knowledge to execute the mission but has not fully leveraged this resource for properly identifying and correcting operational shortfalls in an aircraft's design. Focusing on the Remotely Piloted Aircraft (RPA) community, the research goal is to determine if the Air Force should establish a formal program for collecting and prioritizing unsolicited user change requests from operators, and if so, how should the process be implemented and what characteristics should the system possess. This Delphi study sought consensus from a panel of MQ-1 and MQ-9 expert operators on desired characteristics and basic architecture. The analysis revealed that the deficiency reporting program, traditionally focused on Test & Evaluation squadrons, meets many of the desired characteristics but could be improved to meet all of them. Additionally, cockpit development could improve through supplementing the already established Cockpit Working Groups with a commercially developed tool with many of the desired characteristics.

15. SUBJECT TERMS
end-user feedback; operator feedback; unsolicited change requests; materiel modification

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **U**	b. ABSTRACT **U**	c. THIS PAGE **U**	UU	115	Lt Col Brent Langhals, AFIT/ENV 19b. TELEPHONE NUMBER (Include Area Code) (937) 255-3636 x7402 Brent.Langhals@afit.edu

Standard Form 298 (Rev. 8–98)
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