

Constraints, Limitations and Assumptions



Code of Best Practice

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Purpose and Content

Purpose

To describe study constraints, limitations, and assumptions and the best practices to determine them.

Content

- Definitions.
- Role of Constraints, Limitations, and Assumptions (CLA).
- Factors Influencing CLA.
- Constraints, Limitations, and Assumptions Tenets.
- Measurement Space.
- CLA Development Process.
- Determine:
 - Constraints.
 - Limitations.
 - Assumptions.
- Assumptions to Avoid.
- Illustrative Example.
- Summary.

This Code of Best Practice (COBP) is not intended to be a “how-to” manual for determining acceptable constraints, limitations, and assumptions. Doing so requires study context and practical experience.

Purpose and Content

This Code of Best Practice (COBP) is intended to assist study directors and analysts in identifying the constraints and limitations, and developing the assumptions associated with a study. These are referred to as CLA.

The COBP explains what CLA are, the role they play in a study, and the reason for their importance. The COBP also provides basic tenets for applying CLA and prescribes the recommended approach to use when developing and determining CLA. The COBP also provides examples of assumptions to avoid. The COBP concludes with a summary of the major points covered.

Being able to create acceptable CLA requires that the context of the study be known. The ability to create acceptable CLA is learned by doing, and therefore requires such context and repetitive practical experience. This COBP is not a “how to” primer to teach you how to write CLA. Instead, it provides the correct approach for determining CLA and incorporating them into a study.

This COBP is the first revision to the original published by TRAC in May, 2005.

Definitions

Definitions¹

- **Constraint**: A restriction imposed by the *study sponsor* that limits the study team's options in conducting the study.²
- **Limitation**: An inability of the study team to fully meet the study objectives or fully investigate the study issues.
- **Assumption**: A statement related to the study that is taken as true in the absence of facts, often to accommodate a limitation.

1. Adapted for study purposes from definitions provided in FM 5-0, FM 1-02, and FM 101-5-1.

2. "Study sponsor" includes the sponsor's designated review body (e.g., Study Advisory Group (SAG)).

Definitions

Analysts commonly misrepresent CLA in a study by using them interchangeably. CLA, however, are distinctly different.

The definitions above were adapted from FM 5-0, FM 1-02, and FM 101-5-1. (FM 1-02, which replaced FM 101-5-1, does not define limitation.)

As the definition states, constraints are restrictions imposed by the study sponsor that limit the study team's options in conducting the study. The key element to note in the definition is that the restriction comes from the study sponsor. It is unlikely that a constraint can be ignored or altered by the study team without the consent of the sponsor. The portion of the COBP titled, "Identifying Constraints," indicates likely sponsor study guidance elements that may result in constraints.

Limitations, on the other hand, are restrictions or gaps within the abilities of the study team to address the study issues, and may or may not be a result of constraints. The section of the COBP titled, "Identifying Limitations," discusses potential elements that could result in limitations for the study team.

Often in a study, particularly those that address the future, it is not entirely certain that ideas envisioned about the future will in fact become reality. Study teams develop assumptions, which they treat as facts, to enable them to complete the study. In many cases, an assumption will be made to accommodate a limitation.

Role of Constraints, Limitations, and Assumptions

Constraints, limitations, and assumptions (CLA) are vital to a successful study. They:

- **Bound or scope the study effort by identifying what should be accomplished, and can (or cannot) be accomplished.**
- **Frame the study space and set the stage for the study team's methodology development.**
- **Serve as a “contract” between the study sponsor and the study team.**
- **Provide a basis for the sponsor to reconcile the study results with how the study was done.**

CLA provide the framework for both the study team and the study sponsor to understand the conditions under which the study was conducted and under which the results are applicable.

Role of Constraints, Limitations, and Assumptions

CLA play a vitally important role in a study. At the beginning of a study, the boundaries imposed by CLA serve as a framework for conduct of the study. During and at the end of a study, CLA provide an additional framework within which the study sponsor is able to properly interpret the study results.

At the beginning of a study, the study team determines the CLA. The process of doing so serves to scope the study effort and shape the study methodology. In essence, the CLA bound the study and constitute a preliminary step in the study process. It is only after determining the CLA that the study team can establish an appropriate study methodology. As a simple example, if the sponsor wants results in three months, the study team cannot develop a methodology that requires a six month effort to produce results.

Once the study team has determined the CLA for the study, they must inform the study sponsor of those CLA. Once the study sponsor accepts the CLA, they then serve as a contract between the sponsor and the study team. As mentioned earlier, the CLA dictate study scope, and once the sponsor agrees to the scope, the study sponsor knows what to expect and the study team is clear on what it must provide.

At the end of a study, the CLA enable the study sponsor to properly interpret the study's results. Since the study sponsor is aware of the CLA, the sponsor knows that the study results apply only within the bounds established through the CLA. For a simple example, if the study was constrained to the period up through 2012, the sponsor knows that the results might not be applicable for 2016.

Factors Influencing CLA

Today's decision analysis environment requires an emphasis on CLA in planning and conducting a study.

- **The rapid pace of change in military transformation, technology evolution, and shortened acquisition timelines. Some challenges:**
 - Uncertainties in data and modeling due to concurrencies in developing new concepts, requirements, systems, and forces.
 - Rapid operational fielding and emerging uses in theater.
 - Diminishing fiscal resources.
- **Growing complexity and scope of issues. Some challenges:**
 - Portfolios and systems of systems (SoS) instead of single systems.
 - Joint, interagency, and multinational operations vice Army-only.
 - Increased scrutiny from leadership at all levels of government.
- **Unknowns about the future that may limit the applicability of study results. Some challenges:**
 - The adaptability and resiliency of the threat.
 - Evolving and immature Joint and Army concepts and technologies.
 - The broad spectrum of potential scenarios dictated by the diverse, and often ambiguous Operating Environment of military forces.

These and other factors impose and influence study CLA.

Factors Influencing CLA

CLA deserve special attention and require vigorous application in today's challenging analysis environment. Situations in which analyses are conducted have changed significantly in the past decade, and the CLA that might have once been consistent from one study to another are no longer.

Military transformation is occurring at a rapid pace. The development process is no longer linear but rather a collection of concurrent efforts constantly interacting during development. Technologies, concepts, and forces are changing concurrently. As they do, often in-stride of a study about them, the study team must be adept at identifying appropriate CLA to ensure their study yields credible results. In particular, immature ideas at the onset of a study typically require assumptions to be made and then either modified or replaced by facts as the study progresses. For example, the fielding and use of rapidly-developed systems and capabilities into current operating environments may dictate changes in assumptions about the availability and adequacy of data and what will or will not reside in the force in a particular area of operation (AO) and/or at a given time.

Analysis of the future requires careful consideration of CLA. Anticipating how the threat may adapt, working with concepts that are not yet mature, and using relevant scenarios for future operations create special challenges for the study team in its development of CLA.

In developing CLA, the study team must deal with a much higher degree of complexity and uncertainty than that associated with earlier studies when technology advanced more deliberately and the threat was considered to be more predictable.

Data must be vigorously researched and developed for studies. Lack of data availability may result in study limitations and assumptions.

CLA Tenets (1 of 2)

- **CLA Sets:** Identify two sets of CLA for a study.
 - Full set: The entire set of CLA for the conduct of the study. This set must be understood and agreed to by the study participants. *For analysts to talk with analysts.*
 - Key set: A subset of the full set of CLA that is critical to the sponsor for accepting and interpreting the study results. *For analysts to talk with sponsors.*
- **Audience Focus:** Restrict presented CLA to those most relevant to the intended audience.
 - For example, CLA briefed to the study sponsor should include only those that have significant implications for the study and particular meaning to the sponsor.
- **Existence:** Do not develop CLA simply to “check the box.”
 - Although rare, not every study is constrained, suffer limitations, and/or require assumptions.
- **Acceptability:** Adhere to characteristics of acceptable CLA.
 - Necessary, i.e., they must enable the study effort.
 - Valid, i.e., they are sound and supportable.
 - Accepted, i.e., they are generally agreed upon by study members.

CLA Tenets (1 of 2)

These tenets provide a set of best practices with which to identify constraints and limitations and then develop assumptions.

Identify two sets of CLA. The “full set” includes all the CLA that have a bearing on the study. This set is primarily for use by study participants and must be integrated across the study effort to ensure that the participants are all working within the common framework established by the CLA. A subset of the “full set,” the “key set” consists of those CLA that the sponsor must be aware of in order to accept the terms of the study and accurately interpret its results.

Typically, the opportunity will arise for an analyst to inform multiple parties on the study efforts. Not all audiences are concerned with or need to know each and every CLA; they should be tailored for the specific audience to which they are presented. For example, CLA briefed to the study sponsor should include those that have significant implications for the study and particular meaning to the sponsor, while those briefed to another study participant may be more detailed and technically oriented.

Study teams often struggle coming up with CLA because they feel obligated to have them. Do not develop CLA if unnecessary, simply to “check the box” that you have.

In determining CLA, make sure they are necessary, valid, and accepted. A constraint, limitation, or assumption is necessary if it enables the study effort; that is, it is required to complete the study. It is valid if there is a logical, supportable reason for making it. Finally, CLA are accepted if agreed upon by study sponsor and participants. A CLA that is acceptable requires review of the CLA by the study participants, authoritative sources of study information, and study stakeholders. If CLA are not necessary, do not include them; if invalid, and/or not acceptable, then modify them to meet the characteristics of acceptable CLA.

CLA Tenets (2 of 2)

- **Concurrence:** As early in the study process as possible, identify and develop the CLA.
 - Obtain concurrence from the study sponsor for those CLA that could significantly impact the study.
- **Development:** Initially identify constraints first, then identify limitations, and lastly develop assumptions.
 - Keep a “living” list of CLA as they are identified, developed, mitigated.
- **Evolution:** Continually review CLA over the course of a study and count on them maturing as the study effort matures.
 - Some CLA will endure throughout the study; others will be eliminated, replaced by facts or require change as the study team learns more.
- **Decomposition:** Consider decomposing CLA.
 - By study phase, by study issue, and/or by a limited category set (e.g., administrative, technical/analytic, scenario, etc.).
- **Consistency:** Ensure that CLA are integrated and consistent across and throughout the study effort.
 - Study phase CLA may vary, but must be consistent.

CLA Tenets (2 of 2)

As the study team develops CLA early in the study process to frame the study effort, the team must gain concurrence from the sponsor on those CLA that could significantly impact the study results. The study team may have to engage the sponsor more than once in reaching agreement on the initial “key set” of CLA, which is absolutely critical for facilitating the planning and conduct of the study.

Determine the CLA in that order. The constraints form the initial set of bounds on a study. Within these bounds, the study team is further bounded by its limitations. Based on the constraints and limitations, the study team may have to develop assumptions to clarify and accommodate the bounds resulting from the limitations. In short, CLA build upon one another with a constraint often leading to a limitation and an assumption addressing the limitation.

CLA will mature as the study effort unfolds, and should be continually reviewed during the study and modified as necessary. The sponsor should be consulted if the “key set” changes. Up-to-date CLA are important to maintain a common framework with both the sponsor and the study participants. CLA developed at the beginning of a study effort will frame the conduct of the study. CLA that survive to the end of a study will highlight the applicability of results. Avoid doing CLA only twice during a study; that is, once at the beginning and once at the end. CLA maintenance is a continual process of evolution. Keep them updated.

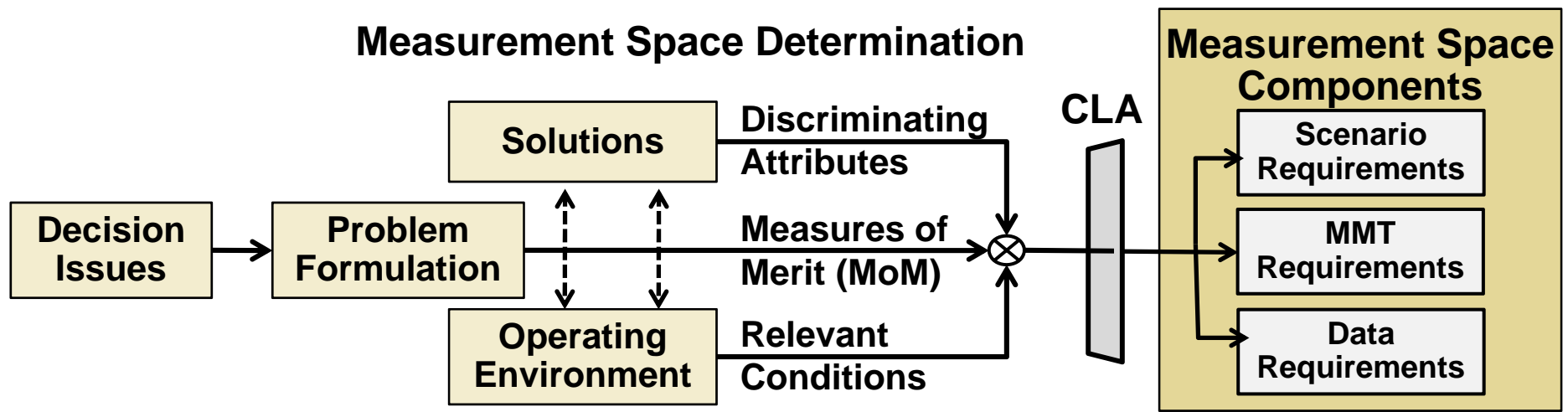
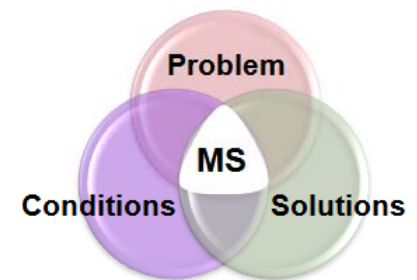
In order to effectively understand and highlight CLA associated with particular aspects of a study (such as performance differences, cost analysis, risk, etc.), the study team may find it useful to “decompose” the CLA into an overarching list, by study phase, by study issue, and/or by a select set of categories.

CLA that have been decomposed must be energetically maintained across all elements of the study team working various tasks or issues of the entire study in order to ensure consistency and avoid disparate choices.

Measurement Space

Measurement space is the set of problem-inducing conditions, that when adequately accounted for in analytic methods, will most likely distinguish between two or more solution options.

- Measurement space identifies the analytic intersection of the problem, the conditions that cause or contribute to the problem, and the attributes of potential solution(s).
- This intersection not only drives the analysis methodology but also informs the measurement space components (scenarios, MMT, and data requirements).
- Measurement space development can help identify and inform CLA.



Measurement Space

Measurement space is the set of conditions that cause or contribute to a problem, that when adequately accounted for in analysis methods, will most likely distinguish between two or more optional solutions based on the attributes of those solutions.

The determination of CLA goes hand-in-hand with the identification and development of the analytic measurement space.

Too often, the analyst leaps straight to problem solving (based on experience with problems that appear similar) without the due diligence to formulate the problem and tailor a relevant methodology. Too often, the analyst also fails to adequately consider and account for all of the methodology components necessary to reveal the salient differences between potential solutions in ways most relevant to the problem.

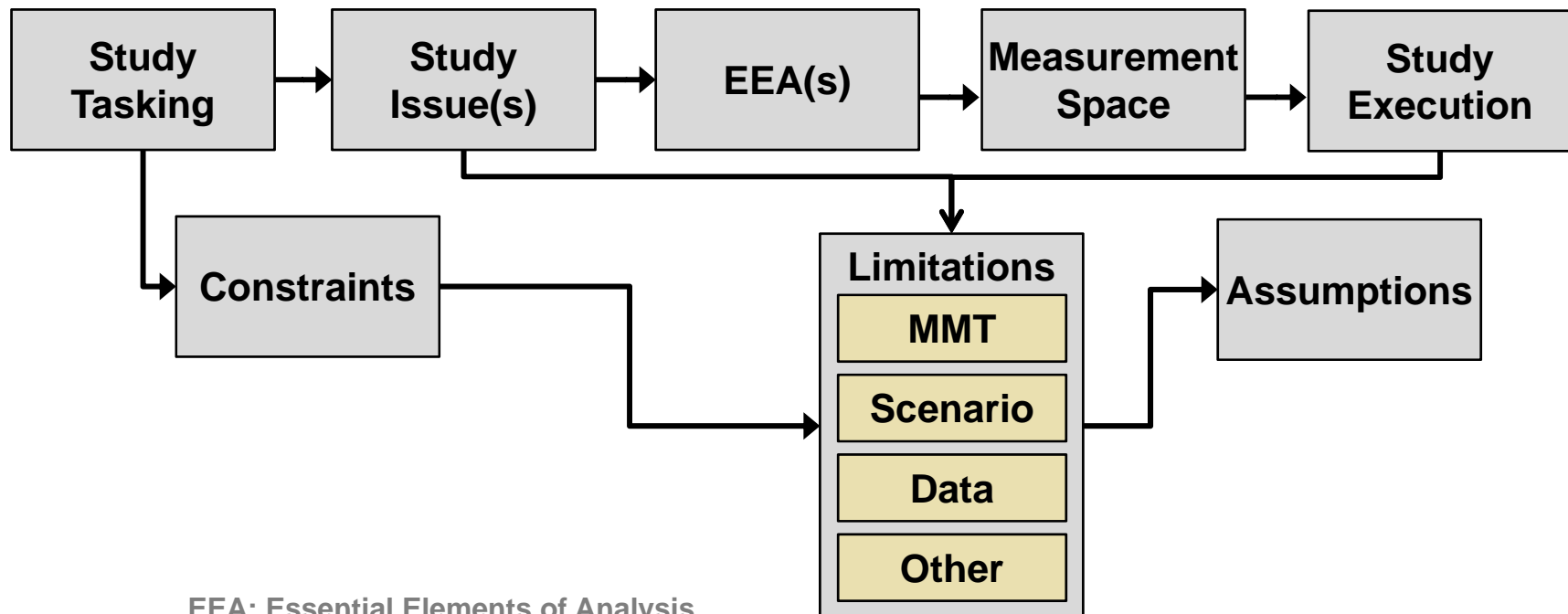
The measurement space concept is a way to logically and systematically think about the problem and how best to analyze it; and not meant to be rigid, prescriptive or formulistic. The measurement space process addresses the following questions: What is the problem? What conditions in the operating environment (OE) contributed to the problem in the first place? What is it about the solutions that promises to remedy the problem? Will the solutions' differentiating attributes reveal themselves under the conditions that induced the problem? Are those conditions sufficiently prevalent in the OE to justify revealing and contrasting (through analysis) the relative benefits of the solutions?

The inability to adequately account for the measurement space in the analysis methods may result in a limitation(s) and/or may require the development of an assumption(s). The determination of measurement space attributes, measures of merit (MoM), and conditions dictates scenario, Methods, Models, Tools (MMT), and data requirements, and their associated CLA.

CLA Development Process

- **Constraints** are defined by the task and the sponsor.
- **Limitation and assumption development is a living process.**
 - Limitations are identified during study planning and execution.
 - Assumptions are developed to alleviate key limitations.

- **Constraint:** A restriction imposed by the *study sponsor* that limits the study team's options in conducting the study.
- **Limitation:** An inability of the study team to fully meet the study objectives or fully investigate the study issues.
- **Assumption:** A statement related to the study that is taken as true in the absence of facts, often to accommodate a limitation.



EEA: Essential Elements of Analysis

CLA Development Process

CLA development begins with the receipt of the study tasking. Often, the study tasking itself provides defined constraints. Additional constraints may be identified in discussions with the study sponsor.

Constraints may limit aspects of study execution; such are captured in limitation identification.

Additional limitations may be identified during the development of the problem statement and study issues; the development of study essential elements of analysis (EEAs); the identification of measurement space, MoMs, and conditions and the development of associated measurement space scenario, MMT, and data requirements; and during actual study execution.

In many cases, assumptions may need to be developed to mitigate critical limitations that inhibit measurement space requirements.

Limitation identification and assumption development is an ongoing process throughout the framework of the entire study effort. Some limitations and assumptions may not be identified and developed until the study is nearing completion.

Identifying Constraints

Constraints dictate the terms under which the study team should conduct the study.

- **Review the study tasker and sponsor's guidance because these items, among others, place bounds on the study by specifying the:**
 - Date by which the study must be completed.
 - Follow-on analysis that must be supported.
 - Study lead and organizations to participate in the study.
 - Materiel options to analyze and/or performance data to utilize.
 - Force structure(s) and force year(s) to consider.
 - Type(s) of military operation(s) and missions to consider.
 - Scenario(s), threats, environments, and world regions to consider.
- **Identify whether and how the sponsor has limited full investigation of the issues. These terms and conditions may be derived from:**
 - Time available (“Were we given enough time?”).
 - Resources available (“Did we get enough people and money?”).
 - Study scope (“Do the bounds we were given provide sufficient, credible measurement space for investigating the issues?”).
- **If a constraint needs to be changed and can be changed (e.g., a specific study scenario), recommend the change to the sponsor.**
- **All sponsor guidance does not constitute constraints and should not be identified as such.**

Identifying Constraints

The first step in developing a set of CLA is to identify the constraints. Begin by reviewing the official study tasker or other guidance from the study sponsor. Be aware that each element of guidance does not constitute a constraint. The analysis task, the issues to be investigated, and assigned agency responsibilities constitute sponsor guidance, not constraints. Constraints arise from those elements of the sponsor's guidance that restrict full investigation of the issues.

The sponsor's guidance that limits the time available for the study, the resources the sponsor (or the chain of command) makes available, and the study scope often lead to constraints. The key consideration in determining if these elements of guidance constitute constraints is the impact the guidance will have on the study team's ability to fully investigate the issues. If the time allotted is very short, there's a good chance that the team cannot credibly or thoroughly investigate issues. If few people are made available to conduct the study, the investigation of the issues may likewise be limited. Finally, the sponsor may sometimes impose a constraint that serves to scope the effort too narrowly. Although less work might be appealing to the study team, a scope that is too narrow could severely limit the applicability of the results. For example, if a study team is working on an investment strategy for a mix of weapons systems that covers the period 2012 – 2020, but the sponsor limits the investigation to forces that will be fielded only after 2016, then the analysis results may not apply to the initial period.

Ensure the constraints meet the characteristics of acceptable CLA (i.e., necessary, valid, accepted). If a constraint unnecessarily limits the full investigation of the issues, attempt to get the constraint changed with the sponsor, identifying to the sponsor the benefit to the study purpose that would result from relaxing the constraint.

Identifying Limitations

Limitations are a study team's inability to investigate issues in accordance with the sponsor's guidance.

- **Within the guidance and constraints established by the sponsor, consider the team's ability to investigate the issues within the time allotted. This might be limited by:**
 - **Concept immaturity (e.g., tactics, techniques, and procedures (TTP)).**
 - **Access to study information (e.g., that requires special clearances).**
 - **Acceptable data.**
 - **Number and type of available scenarios.**
 - **Available MMT and their capabilities.**
 - **Available qualified study participants.**
- **Do not label as a limitation an item the study team imposes on itself.**
- **The impacts on the study for each limitation must be understood.**
- **If a limitation can be acceptably accommodated by an assumption or overcome by having the sponsor change a constraint (e.g., study due date), recommend the change to the sponsor while identifying how the change will benefit the study.**
 - **Technical, analytic, and scenario limitations can, and should, be commonly overcome with assumption(s).**

Identifying Limitations

Limitations are those actions or tasks that a study team can or cannot accomplish. After identifying study constraints, determining limitations is the next step in the CLA process. As with constraints, a principal consideration in identifying limitations is the impact on the study team's ability to fully investigate study issues.

Constraints form the initial set of bounds on a study. Determine limitations from within these bounds. Limitations can arise from an inability to meet an identified measurement space requirement; such generally fall into the categories of knowledge, scenarios, MMT, and data. Some examples: immature concepts result in a lack of knowledge about the conduct of operations; scenarios do not exist for the geographic region or operation of interest; models may not exist for determining the impact of a technology or capability on the threat; data may not be refined enough to predict the performance of a future system. Each of these could lead to study team limitations.

Avoid imposing limitations that do not exist. Often, an agency will restrict itself to in-house tools. This constitutes a self-imposed limitation that should be avoided.

The study team must understand the first-order and second-order impacts of each identified limitation that describes an action or task that cannot be accomplished. These impacts should be understood across all study phases and sections (i.e., a limitation identified in the performance analysis might impact the cost analysis).

Limitations can often be accommodated with a reasonable assumption that is acceptable to the study participants and sponsor. A limitation may also be overcome if a study sponsor changes a constraint. For example, a limitation associated with acquiring acceptable data may be overcome if the study sponsor agrees to an extension of the study completion date. If a change to a limitation benefits the investigation of the study issues, work with the study sponsor to overcome that limitation.

Developing Assumptions

Assumptions are study-specific statements that are taken as true in the absence of facts.

- **Identify the unknowns and/or uncertainties that have the potential to impact the study. For example:**
 - **“Will there be sufficient number of “New Start” Weapon X to equip every System Y depicted in the study’s 2016 scenario?” (This might arise from a constraint about force structure, force year, and scenario.)**
 - **“How does System Y obtain targets detected by Unit Z?” (This might arise from a limitation dealing with concept immaturity.)**
- **Decide whether developing an assumption to account for an unknown and/or uncertainty is required for the study (e.g., without it, a critical measurement space requirement cannot be met).**
- **Find out what’s known about the constraint or limitation and develop a valid assumption (e.g., “There will be sufficient weapons of type X in the inventory to fully equip the systems in question.”).**
- **Coordinate and staff the assumption with subject matter experts and appropriate authorities to determine its suitability.**
- **Understand the impacts of assumptions across the study.**
- **It is not necessary to develop assumptions to account for every unknown arising from limitations.**

Developing Assumptions

When a limitation cannot be overcome and may impose a significant impact on the study's conduct or continuation, the limitation may need to be addressed through an assumption. A study assumption is an informed "study-specific" statement that is taken as true in the absence of a fact.

Assumptions help identify what is unknown and/or uncertain as a result of the limitations. Once a study team identifies the limitations, they must ask, "Is overcoming this limitation necessary for the successful conduct and completion of the study?" A number of these questions will arise from the determination of measurement space requirements, measures of merit, and conditions and associated scenario, MMT, and data requirements. If the answer is yes - overcoming the limitation is necessary, the team must develop an assumption.

The examples under the first bullet on the previous chart illustrate potential unknowns by a study team. In order to conduct the study, the team would need to make assumptions to compensate for the unknowns. Informed of the assumptions, the sponsor will know the results will be impacted if assumptions turn out not to be true.

In a number of cases, a limitation may not require an assumption, or the study team may not be able to develop a valid, accepted assumption. In this case, retain the limitation and make it known in order to inform the study sponsor of those areas for which study results may not apply or which may need reconciliation with other pertinent information. Do not make up an assumption that is not sound and supportable simply to address the limitation.

As described for limitations, the study team must understand the first-order and second-order impacts of each developed assumption.

There is no requirement to have a certain number of assumptions. If you do not have any, do not make them up!

Assumptions to Avoid

- Do not confuse an “assumption” with statements about “constraints,” “limitations,” “methodology,” etc.
- For example, do not treat these as assumptions:
 - “Agency-certified data accurately reflects the characteristics of the systems used in the study.” An authoritative source’s certification of data serves as a statement of its accuracy. This is not an assumption.
 - “The scenarios used in the study represent plausible future combat operations.” Scenarios are developed to represent plausible future combat operations. This is not an assumption.
 - “The study will employ stochastic methods to determine the outcome of Red on Blue engagements.” This statement describes a method that will be employed in the conduct of the study. It describes an aspect of the study methodology and is not an assumption.

Assumptions to Avoid

One of the principal obstacles a study team has in developing CLA is not being familiar with the definitions of each. Adhere to the definitions and follow the accepted practice and sequence in developing CLA.

The previous chart highlights some common problems with assumptions. In the first two examples, the assumptions address areas (data and scenarios) that a study team obtains from authoritative sources. There is no reason to make an assumption in these cases. The study team can instead address this sort of information as a fact associated with the conduct of the study. Note, however that the application of specific aspects of a scenario as representative for the analysis may constitute an assumption. For example, “the mission demands within the scenario used are assumed to be representative of a systems’ life-cycle requirements thereby impacting system numbers and program costs.”

Another common problem with assumptions is a study team introducing aspects of the methodology into the assumption. The statement like that in the third example above should be reserved for the description of the methodology.

In addition to the examples illustrated above, introducing facts in assumptions is also a common occurrence. If an element of information is simply a fact associated with the study or its elements, do not include it among the assumptions.

Illustrative Example

Tasking and Guidance

Study Tasking and Guidance

- In August 2011, the Office of the Secretary of Defense (OSD) directed the Army to conduct an assessment of select non-developmental vehicles (NDVs) to inform the ground combat vehicle (GCV) Milestone B Analysis of Alternative (AoA) Dynamic Update and GCV capability development document (CDD) requirements.¹
- The assessment consisted of an operational and technical assessments (OA and TA). TRAC was tasked to act as analytic lead for the OA. OSD provided the following guidance:
 1. DA will submit to OSD its plan for assessment, including resourcing for the assessment, of NDVs by 23 Sep 11.
 2. The assessment of NDVs will include comprehensive assessments of multiple configurations and families (mixes) of vehicles (e.g., Namer, Stryker, various approaches based on the Bradley, etc.), which could provide affordable, effective, and suitable capability in the required timeframe.
 3. Vehicle assessment will include alternatives for lethality systems (e.g., remote controlled weapons stations, unmanned turrets).
 4. Data and assessment results will inform requirements, performance, schedule, and affordability trades within the AoA Dynamic Update.
 5. The assessment of NDVs will address operational energy in accordance with Department strategy.
 6. The Army will provide in-progress reviews to OSD in January, July, and December 2012 in order to develop the CDD by 2QFY13.

¹GCV IFV MS A Acquisition Decision Memorandum (ADM) dated 17 Aug 11.

Illustrative Example

Tasking and Guidance

In this illustrative example, a study team is conducting analysis to inform ground combat vehicle (GCV) requirements and options. The chart above illustrates the tasking and guidance that the study team received from the Office of the Secretary of Defense (Acquisition, Technology, and Logistics (OSD AT&L)).

Recall that all sponsor guidance does not constitute constraints. In the example above, all of the guidance serves to frame the study effort. Some of this guidance will result in constraints on the study team. The next section describes additional information that the study team learned after receiving the task.

Illustrative Example

Study Team Initial Research

- Identified the Namer as the primary NDV.
- Learned the Army's problem statement for this assessment: Determine how the NDV candidate (Namer APC) operates in a combat environment using U.S. Army personnel, doctrine, and TTP.
- From the problem statement, the study team developed three study issues that provided the guiding framework for the assessment: 1) How do the Namer APC attributes inform the DRAFT CDD requirements, 2) How does equipping a mechanized infantry platoon with a Namer APC impact mission effectiveness, specifically regarding TTP, crew/battle drills, and mission accomplishment, and 3) What are the DOTLPF implications of equipping a mechanized infantry platoon with a Namer APC?
- Learned that multiple versions of the Namer exist in the Israel Defense Forces vehicle fleet.
- Developed a phased assessment plan: "Phase I," evaluate the Namer against draft GCV CDD requirements and inform/update the requirements within that document; and , "Phase II," conduct an operational assessment of the Namer variants.
- The team developed and defined the measurement space to focus on during the assessment. The team identified the differences between the Namer's attributes and the CDD requirements and assessed whether a difference was significant enough to determine its impact (operationally); in addition, the tactical and operational conditions had to be created that would most likely reveal the identified differences.

Illustrative Example

Study Team Initial Research

After receiving the initial tasking the study team conducted a robust front-end analysis before beginning the building of the analytic framework for the assessment.

The problem statement and study issues were first defined, as outlined in the CLA development process. These served to scope the analysis. EEAs were developed and mapped to the various study issues, in order to provide the baseline structure to measurement space development.

This research identified a range of crucial considerations impacting the analysis. These typically influence the level of resources (personnel, time, and/or model and simulation utilization) required to execute the analysis and/or indicate associated limitations, subject to execution and analytic constraints and mitigated by relevant assumptions.

The next section illustrates those elements of the sponsor tasking that form guidance and dictate constraints on the study.

Illustrative Example (1 of 2)

Guidance & Constraints

- **Guidance.** Study sponsor guidance provides the initial bounds placed on a study (e.g., the study team will):
 - The assessment of NDVs will include comprehensive assessments of multiple configurations and families (mixes) of vehicles.
 - Vehicle assessment will include alternatives for lethality systems.
 - Data and assessment results will inform requirements, performance, schedule, and affordability trades within the AoA Dynamic Update.
 - The assessment of NDVs will address operational energy in accordance with Department strategy.

Illustrative Example (1 of 2)

Guidance & Constraints

An element of a study sponsor's guidance is a constraint if it limits the study team's ability to fully investigate the issues. On the chart above, the items included in the first major bullet frame the study for the study team. In essence, they are like mission statements that an operational unit would receive from a higher headquarters. These particular statements tell the study team what to do and don't form any restrictions that would impact the full investigation of the issues.

As mentioned earlier, constraints can arise from sponsor guidance on time available, resources available, and effort scope. These are presented on the following slide.

Illustrative Example (2 of 2)

Guidance & Constraints

- **Constraints.** In some cases, the study sponsor's guidance limits the study team's options and constitutes constraints (e.g., the team must):
 - DA will submit to OSD its plan for assessment, including resourcing for the assessment, of NDVs by 23 Sep 11. *This limits the time available to the team.*
 - The Army will provide in-progress reviews to OSD in January, July, and December 2012 in order to develop the CDD by 2QFY13. *This further limits the time available to the team.*
 - The assessment of NDVs will include comprehensive assessments of multiple configurations and families (mixes) of vehicles (e.g., Namer, Stryker, various approaches based on the Bradley, etc.). *This specifically lists several vehicles that must be included within the assessment.*
 - Vehicle assessment will include alternatives for lethality systems (e.g., remote controlled weapons stations, unmanned turrets). *This also specifically lists alternatives that must be considered.*
- **Additional communication with the sponsor and the study team identified and negotiated additional constraints:**
 - OA Phase I will be completed NLT Mar 2012.
 - OA Phase I will occur at Israeli facilities in Jan/Feb 2012.
 - OA Phase I will use GCV CDD version 2.1 and IFV Annex C version 27, both dated 9 Aug 11. *This limits applicability of results should GCV CDD requirements change.*

Illustrative Example (2 of 2)

Guidance & Constraints

The elements of guidance in the second major bullet constitute constraints on the study. These specific constraints arise from sponsor guidance on time available and effort scope.

Guidance items 1 and 6 require the study team to provide results by certain dates. In specifying this time, the sponsor has constrained the study team to providing results on certain dates that may prevent the study team from incorporating key elements of analysis that would fully inform the issues under investigation.

Guidance items 2 and 3 specify systems and alternatives that must be addressed within the analysis; these constitute constraints on the scope. The purpose of the study is to inform acquisition options for the GCV. By specifying the vehicles to be examined, and limiting the time available to execute the analysis, the study team may propose options that do not incorporate possible additional vehicle solutions.

Overarching tasking constraints should be discussed with the entire study team and sponsor. In this example, such discussions identified that, in order to provide adequate time for the operational assessment (OA) analysis and thereby adequately inform the results to feed the GCV CDD update, Phase I OA must be completed by March 2012.

Additional discussions with the sponsor identified that vehicles assessed within the OA were to be evaluated against requirements specified within the GCV CDD version 2.1 and IFV Annex C version 27.

Illustrative Example

Limitations

- Some limitations result from an inability to obtain information and data:
 - Language barriers complicated the sharing and mutual understanding of information.
 - Agreements on information sharing between the U.S. and Israel restricted the study team's knowledge of certain capabilities of the Namer. *These limitations restricted a detailed evaluation of particular Namer capabilities.*
- Some limitations result from MMT and/or system limitations:
 - Legacy instrumentation equipment used by both EXFOR and threat forces was not consistently reliable, and direct/indirect and IED engagements frequently required adjudication by Observer Controllers (OCs) on the ground. *This caused tactical analysis and insights development to be more dependent on subjective judgment and Soldier feedback.*
- Some limitations result from the combination of shortcomings in scenario and operational environment representations and study deadlines.
 - Short dwell “in the box” limited data collection on sustainment requirements. *This limited data availability and capture (and subsequent statistical review).*
 - Repetition and assessment design caused the EXFOR and threat to anticipate contact on each run (surprise was not complete). *This limited the range of operational conditions under which the vehicle was investigated.*
- When briefing a study plan or results, describe the impacts of the limitation and/or the approach used to mitigate the limitation.

As the study team develops the study methodology and selects its tools, it will need to re-visit the limitations (and assumptions).

Illustrative Example

Limitations

The section of this guide that addresses the areas that might lead to limitations highlights knowledge, scenarios, MMT, and data. It also mentions that limitations arise from a study team's inability to incorporate an element in a reasonable amount of time.

The chart above illustrates how a constraint (the time allotted for the study), combined with a lack of complete access to data and a lack of operational environment representations, leads to limitations for the study team.

In the examples shown under the first major bullet, the study team will not have access to the quantity and types of knowledge and data that might be necessary to fully assess the various vehicles. The only way the study team would be able to overcome this limitation would be if they were given more time to become more familiar with Israeli operations and if they were given access to critical Namer performance data (survivability, etc.).

The second major bullet highlights gaps in the assessment execution method that could limit the applicability of the study results. The lack of functional systems (tools) restricted a full understanding of Namer's contribution to mission effectiveness. This could have only been overcome with more time and effort to address the limitations.

The third major bullet identifies limitations inherent in the scenario and the operational environment, both from a terrain and time aspect and from a threat aspect. These limitations could be overcome by an increase in time allowed for the assessment (to enable more "time in the box" and allow for various threat stances) and by providing a larger, and more terrain-variable, assessment environment.

The next section of the briefing identifies which of these limitations the study team can address with assumptions. Some of these limitations cannot, however, be addressed with assumptions that meet the standards of an acceptable assumption.

For limitations that the study team cannot address with an assumption, the study team should inform the sponsor of the impact a limitation has on the study results.

Illustrative Example

Assumptions

- Some limitations don't need an assumption because an assumption may not be necessary (or even valid). For example:
 - “Namer APC capabilities insufficiently described (lack of data/info) will not significantly impact the assessment results.” *This would not be a valid assumption to address the limitation in question; in this case, this assumption was not made. In fact, agreements on information sharing between the U.S. and Israel did limit the study team's knowledge of certain capabilities of the Namer.*
- Some assumptions are necessary to continue the study. For example:
 - Operations conducted at the platoon-level were sufficient to assess Namer APC impacts on mission effectiveness. *This enabled the study team to interpret PLT-level assessment results and make appropriate implications for combined arms operations above PLT-level (i.e., companies, battalions, etc.).*
 - Legacy instrumentation equipment and its emplacement on the vehicles used by EXFOR and threat forces did not alter mission outcomes. *This allowed the study team to rule out instrumentation as a variable to be specially dealt with in the analysis plan.*
 - New equipment training enabled EXFOR to adequately understand Namer APC capabilities and its potential for employment in the operational assessment vignettes. *This enabled the study team to treat Soldier feedback and crew operation of Namer as acceptably accounting for Namer's capabilities.*

During conduct of the study and execution of the MMT, the validity of each limitation should be carefully weighed through interpretation of data and results, and/or sensitivity analysis.

Illustrative Example

Assumptions

As mentioned, the study team can develop an assumption to address a study limitation. These assumptions enable continuation of the study effort.

The first major bullet on the chart above highlights an assumption that the study team should not make. As long as the study sponsor understands the data limitations, the study team does not need to make an assumption that could be an arguable one. The illustrative assumption offered in this example would not likely be acceptable.

The second major bullet highlights necessary, valid, and likely acceptable assumptions that the study team should make. Since the study effort addresses vehicular options, reaching resolution on small-echelon mission effectiveness applicability to larger formations composed of such vehicles is important. Additionally, issues associated with system and MMT functionality and player training are necessarily addressed with assumptions. In this case, the second and third assumptions could be disputed, but also qualified by the study team during assessment execution by observation, interpretation of results and/or sensitivity analysis, and at the very least are made known to the sponsor for his own reconciliation of the assessment results and findings.

It is evident that assumptions flow directly from study limitations. In briefing a study plan or results, it isn't necessary to list both the limitation and the assumption developed from the limitation. If the study team can address the limitation with an assumption, highlight only the assumption. If an assumption isn't necessary or if the study team cannot develop a valid, acceptable assumption to address the limitation, then leave the limitation as is and describe the impact of the limitation to the study sponsor.

Summary

- **Constraints, limitations, and assumptions:**
 - Are vital elements of a study and the study process.
 - Constitute bounds on a study and the study team.
 - Are identified and developed in order: C, L, A.
 - Need to be determined early in the study process and require careful consideration, formulation, review, and acceptance.
 - Are a necessary precursor upon which to base the study methodology.
 - Need to be reviewed throughout the study, and adjusted if appropriate.
 - May consist of a full set and a key subset, the latter being more appropriate for the study sponsor.
 - Serve as a contract between the study team and study sponsor.
 - Most importantly, are vital to properly interpret and use the study results.
- **Constraint:** A restriction imposed by the *study sponsor* that limits the study team's options in conducting the study.
 - **Limitation:** An inability of the study team to fully meet the study objectives or fully investigate the study issues.
 - **Assumption:** A statement related to the study that is taken as true in the absence of facts, often to accommodate a limitation.

Summary

Constraints, limitations, and assumptions are a critical part of the study process. They are an important tool in establishing the bounds of a study and communicating with a study sponsor.

There are six basic tenets necessary to follow when determining CLA: (1) identify and develop CLA in order; (2) identify two sets of CLA (full and key); (3) ensure all CLA are necessary, valid, and accepted, (4) continually review and update CLA; (5) tailor CLA to the specific audience; and (6) ensure CLA consistency across the study.

Where time and resources permit, the impact of limitations and validity of assumptions should be addressed by the analysis itself.

Adhering to these basic tenets contributes greatly to enabling a successful study and communicating the results.