CHAPTER 5
SURVEY PLANNING

Survey planning is initiated at the maneuver commander’s level, and is conducted at all levels down to the survey team chief. Planning is affected by many factors ranging from the commander’s guidance, to unit SOP, to the individual surveyor’s ability. This chapter will discuss these factors as well as provide options and guidance for the formulation of a realistic and timely survey plans.

Section 1
THE PLANNING CHAIN

5-1 The Operation Order/Plan

a. The commander initiates the requirements for survey planning when he issues guidance in the form of an operation order or plan. He does so by stating his intent, scheme of maneuver, the rate of movement, the anticipated enemy threat, and the critical phases of battle.

b. The operation order is issued in the five-paragraph order format, and may be a short oral order or, a very large written text. This order will be the basis for any other order produced during the operation. As situations change the base document will remain the same, only the paragraphs with changes will be reissued in the form of a Frag Order. The Op Order will not contain SOP information.

5-2 The Artillery Fire Plan

a. The Artillery Fire Plan is part of the Maneuver Commander’s operation order based on the fire support plan, and contains information necessary for understanding how the artillery will be used to support the maneuver element.

b. The Artillery Fire Plan follows the five-paragraph order format and is Tab B to Appendix 19 (Fire Support) to Annex C (Operations). Some of the essential elements of the artillery fire plan necessary for survey planning are listed below:

1. Allocation of all artillery assets.

2. Projected changes to the allocation of artillery assets based on tactical contingencies in the operation order.

3. The artillery Commander’s concept of Artillery support. (Paragraph 3b of the Artillery Fire Plan.)


5. Locations of command posts. (Paragraph 5 of the Artillery Fire Plan.)

6. Artillery targets. (Encl. 1 of the Artillery Fire Plan.) This may consist of a target list worksheet and scheduling worksheet. A target list is also included in the fire support plan that includes all targets, not just artillery targets. This list may be needed for planning target surveys for non-artillery targets.

7. Initial positions and planned movement of firing units to support the fire support plan. (Encl. 2 of the Artillery Fire Plan; an overlay may be included.) This enclosure lists initial position areas assigned to artillery units and their firing capabilities. Unit boundaries and range fans are depicted on the overlay.
8. Artillery target overlay. (Encl. 3 of the Artillery Fire Plan.) The overlay includes artillery targets, fire support coordination measures, and unit boundaries.

9. Observation and Target Acquisition Plan. (Encl. 5 of the Artillery Fire Plan.) This enclosure contains information concerning battlefield observation. It outlines mission statements for the collection of specific information, reporting requirements, positioning, and sectors of coverage of the artillery’s target acquisition assets (e.g., FOs, OPs, radar, air observers, and UAV/RPVs).

5-3 The Survey Plan/Frag Order

a. General. The survey plan is written in the five-paragraph order format. The survey plan is contained in Enclosure 6 of the Artillery Fire Plan, which is Tab B to Appendix 19 (Fire Support) of Annex C (Operations) of the Operation Order/Plan. The five paragraphs in the survey plan will not duplicate the higher level planning documents. Only information necessary for the survey teams to complete their mission is included.

b. Five-Paragraph Order. The five-paragraph order, as it pertains to a survey plan, is written as follows:

1. Situation. This paragraph consists of the general situation as it pertains to survey operations to be conducted.

   Enemy. Intelligence information regarding the enemy situation as it affects survey (routes, weapons, etc.).

   Friendly. The friendly (higher, lower, and adjacent units) situation as it affects survey.

   Attachments and Detachments. Units who can provide support to the survey mission (i.e., security, maintenance, etc.), or that are attached to the section.

2. Mission. This paragraph is a clear, concise statement of what must be accomplished.

3. Execution. This paragraph consists of several subparagraphs that answer the questions; who, what, where, and when. It will further establish priority of work, and the preferred survey methods to be used.

   a. Concept of Operation. This subparagraph describes the survey methods to be used.

   b., c., d... Specific Instructions For Each Party. These subparagraphs contain specific instructions each team needs in order to accomplish its portion of the survey mission. Survey control to be used by this team, general locations (6-place grids) for required control, and information which deviates from SOP are listed in these subparagraphs.

   e. Coordinating Instructions. The last subparagraph contains instructions and/or information common to two or more parties. (timelines, rally points, etc.)

4. Administration And Logistics. This paragraph contains information necessary to insure service support is adequate for the mission. Information concerning rations, ammunition, aid stations, handling of prisoners, etc. will be addressed in this paragraph.

5. Command And Signal. This paragraph contains information such as the location of the survey officer, survey chief, chain of command, frequencies, call signs, medevac procedures, and communications between survey teams.

c. Frag Order. Once the operation, or a particular phase of an operation begins, the situation changes and occurrences develop which will affect the way fire support assets are deployed on the battlefield. When this happens, the survey officer must issue a survey frag order, and will only issue paragraphs two and three of the five-paragraph order. If however, the other paragraphs have changed, the survey officer may decide to issue the portion of those paragraphs that have changed.
5-4 Survey Planning And Common Grid

a. The survey plan is contained in Enclosure 6 to TAB B (Artillery Fire Plan), to APPENDIX 19 (Fire Support) to ANNEX C (Operations). This enclosure is titled Survey/Met Plan and is inclusive of both the survey and the meteorological plans of the unit. This chapter will discuss the survey plan only.

b. Survey planning is initiated with the operation order. Information drawn from SOP, the operation order, the fire support plan, and the artillery fire plan, is used to generate the survey plan. The survey plan must provide for a common grid. If this is not possible, the plan must provide for conversion to a common grid as soon as possible.

c. The survey plan must be simple, flexible, and adaptable to the chaotic and rapidly changing environment of the battlefield. Additionally it must provide required control, provide checks, and be timely.

d. Ultimately the survey plan will result in an order issued to the survey section. Execution of this order will ensure accurate and timely fires are delivered, and help alleviate any lapse in fire support to the maneuver commander.

5-5 Conduct Of Planning

a. Survey planning is conducted at all levels at the same time. Coordination between higher, lower, and adjacent survey sections during planning will ensure even distribution of the work load, eliminate duplication of work, and provide a focus of effort in establishing a common grid.

b. To begin survey planning the Survey Officer must have a thorough understanding of the Commander’s intent, and concept of operations. This understanding will allow him to prioritize which surveys should be conducted first, and what time constraints he has for completion. He can then consider all the other factors that will impact the survey plan.

c. Coordination with the Commander’s staff, primarily the S-3 and S-2, in developing the survey plan is paramount.

1. The Survey Officer will generally receive the Commander’s guidance through the S-3. He can provide the Survey Officer with operational information that will affect the Survey plan. Furthermore, the S-3 must be kept informed of all survey related problems that will affect the firing units and fire support assets.

2. The S-2 can make available mapping, charting, and geodesy products as well as friendly and enemy situations for the area of operations. He may also request information be obtained during the course of survey operations with regard to routes of march, road conditions, terrain conditions, volume of refugees, etc.

5-6 Factors Affecting the Survey Plan

a. In formulating the survey plan, the Survey Officer must make an estimate of the situation. METT-TSL provides the framework for that estimate. (Mission/Enemy/Terrain & Weather/Troops-Time/Space/Logistics) METT-TSL considerations include, but are not limited to;

1. MISSION: The tactical mission of the artillery unit, and supported unit(s) will determine the priority of survey work, and the accuracy required. It also gives an understanding of the environment the surveyors will be operating in, (i.e., defensive, offensive, high intensity, low intensity, etc.). Rules of Engagement, fire support coordination measures, and boundaries, may hinder survey operations by restricting survey methods, or access to Survey Control Points.

2. ENEMY: The enemy situation has a tremendous influence on survey operations. The disposition of enemy troops may interfere
with, or limit, the movement and capabilities of survey personnel. Restrictions on communications, such as radio silence, and jamming, can greatly reduce a survey team’s effectiveness. The ability of the enemy to degrade survey operations by denying terrain or routes of march is a prime consideration. Marine surveyors must be able to readily identify enemy vehicles, and positions they may encounter, and be trained to call for and adjust fires on those targets. The survey section must be equipped, and trained to take immediate action in response to the type of enemy force they may encounter. (e.g., regular troops, militia, guerrillas, etc.) Enemy air capabilities are also of importance due to the vulnerability of survey teams. Lengthy initialization times with PADS, or occupying traverse and GPS stations leave the surveyors exposed to air attack and observation.

3. **TERRAIN and WEATHER:** Terrain and weather encountered will be a primary factor in determining which method of survey to use, and, to some extent, the priority of installations to be surveyed first. The survey planner must be familiar with the influence of terrain and weather on survey operations. Adverse weather conditions greatly reduce the capability of the survey teams. Fog, rain, snow, or dust can make observation through optical instruments virtually impossible. Extreme heat or cold decrease efficiency, and increase the time needed to complete survey. Reconnaissance to determine the suitability of terrain for the installation to be surveyed is vital. Alternative areas may be required once the proposed position has been reconnoitered.

4. **TROOPS AND FIRE SUPPORT:** The personnel and equipment available to perform the survey mission greatly affects the plan. The level of training determines the methods and time required to complete the mission. The availability and condition of surveying equipment may further dictate what methods can be used, and the time required. Availability of fire support is largely dependent upon the tactical mission of the artillery unit (i.e., DS, GS, GSR, R). For the most part the survey section must rely on it’s own organic weapons due in large part to the independent nature of survey operations, and because the majority of survey operations will be conducted behind the FLOT.

5. **TIME:** The time available to complete the survey is critical in planning. Providing the required data within the time allotted may result in a loss of accuracy. The commander must be advised of any possible loss in accuracy due to time constraints, and decide if this is acceptable. Time limitations may often be implied or ambiguous and require clarification.

6. **SPACE:** For the survey planner space is restricted to his operational area, within his unit’s boundaries. Available survey control may only exist outside these boundaries thus requiring additional coordination and planning. Possibly the terrain within a unit’s proposed boundary may not be suitable for them to occupy.

7. **LOGISTICS:** Availability of logistical support must be considered in all planning. The survey section has a wide array of equipment that may need servicing or repair. Regardless of the survey method used surveyors are heavily reliant their motor transport assets to complete their mission. At the same time they are operating over a broad area far from their logistics base. Chow, ammunition, water, and POL are just some of the supply issues that must be addressed.

b. The elements of METT-TSL are all interrelated and must be considered together. It is a dynamic framework, not a checklist. Some other factors may have an effect on a survey plan but are not necessarily covered in METT-TSL, i.e., refugees, political/diplomatic agreements, etc.

c. In addition to evaluating the factors of METT-TSL, the survey officer must also understand the characteristics of the different survey methods, their advantages and disadvantages, and their impact on mission accomplishment.

**Position And Azimuth Determining System (PADS).** The PADS is a vital survey asset. The speed at which PADS can provide survey data is it’s primary advantage. The following considerations must be made when planning survey operations including PADS.

1. Is existing control accessible with a military vehicle? If not, is existing control within 16 meters of a location that will allow autoreflection?

2. Is the area of operations between 75° N and 75° S latitudes? (PADS operational limits)
3. Planning Times. The following vehicle speeds and system times should be used for planning with PADS operations:

- Cross-country: 10 KPH
- Unimproved Roads: 25 KPH
- Improved Roads: 50 KPH
- 30-day Bias: 2-3 hours
- Initialization: 30-45 min
- Update/Mark: 5 min
- Autoreflection: 15 min
- Mission Time: Unlimited

4. Is existing common control available within 55 kilometers of the planned update point that can be used for future updates?

5. Does the PADS support the operational ellipsoid in the operation order? If not, is user-defined data available?

6. Does the PADS meet the accuracy requirements for the unit being supported?

Traverse. Traverse is the preferred conventional method of survey. The following considerations must be made when planning survey operations including Traverse:

1. Is existing control available of the proper accuracy? Are azimuth marks available for computed azimuths, or do azimuths have to be determined by astronomic observations?

2. Is the area of operations between 84° N and 80° S latitudes? (This is the UTM north and south limits. Most survey computers used by artillery surveyors will only compute traverses in UTM.) If not, does the section have the capability to perform manual computations?

3. Planning Times. The following vehicle speeds and planning times should be used for planning with traverse operations:

- Cross-country: 10 KPH
- Unimproved Roads: 25 KPH
- Improved Roads: 50 KPH
- Distances Traversed: 1-20 KPH (Line of sight dependent)
- LOS Clearing: Jungle: 100 meters per hour
- Forest: 1 KPH

Many different considerations come in to play with planning a traverse on a timeline.

a. How far is existing control from the area requiring survey?

b. How much line of sight cutting is required? Is engineer equipment (chain saws, weed-eaters, bulldozers, etc.) available to help cut line of sight?

c. Is the control accessible by military vehicles or does equipment have to be carried into the area?

d. What is the required accuracy?

4. What means of communications between team members is available? (radio, panel marker, hand and arm signals, etc.)

5. Will traverse provide a timely enough response to the need for survey data?

Intersection. This is the primary method of survey used to determine target locations. Considerations for intersection include visibility, the accessibility and availability of control (OPs), azimuth marks, and communications between teams. Intersection can also be used to provide update and initialization points for PADS, or to locate other critical points other than targets.

Astronomic Observations. When weather conditions allow the observations of celestial bodies, the Artillery Astro Method is the primary means used to determine an azimuth. (The firing battery’s primary method of astronomic observation is Hasty Astro.) The following considerations must be made when planning survey operations that include astronomic observations:

1. Do weather conditions allow observations of celestial bodies?

2. Do celestial bodies fall inside of allowable observation windows, relative to time and position of the body?

3. What is the required accuracy?

4. Is accurate time available?

Real Time Kinematic (RTK) On The Fly (OTF) GPS Survey. RTK/OTF is the newest method available to Marine artillery surveyors. Accuracy achieved by this method is well above that necessary for most artillery survey missions and this is the
fastest method available to provide survey data. The following considerations must be made when planning survey operations including RTK/OTF.

1. Is existing control available or will the base station be operated in the absolute mode? If control is available, is enough control of adequate accuracy available to be used as calibration points?

2. Are enough communications assets available to provide each GPS team with a voice radio and an additional SINGARS radio for digital communications between the receivers?

3. Have communications lines of sight been verified in the areas requiring control? If not, has a map reconnaissance shown that communications lines of sight are clear?

4. Are alternate sites available for the base station when communications are not available or the tactical situation forces evacuation of the original position?

5. What is the required accuracy?

6. Is electronic line of sight to the satellites available? If not, is engineer equipment (chain saws, weed eaters, bulldozers, etc.) available to help cut electronic line of sight.

7. Are planned base receiver sites within 10 kilometers of installations requiring survey? If not, are supplemental positions available?

8. What are the enemy radio direction finding assets?

**Static / Rapid Static GPS Survey.** Static / Rapid Static survey is the most accurate method available to Marine artillery surveyors. Static GPS methods provide geodetic level accuracy and are used to establish high order survey networks. The following considerations must be made when planning survey operations including Static methods.

1. Is time available for occupation of sites and post processing?

2. Is existing control of sufficient accuracy to allow for adjustment of GPS measurements?

3. If no control is available, can absolute stations be established distant enough (at least 50 kilometers) from each other to allow for adjustment of GPS measurements?

**5-7 Environment**

a. **General.** Survey operations must continue regardless of environmental factors such as climate and terrain. The types of environmental conditions that will be encountered must be considered in survey planning.

b. **Arctic Areas and Cold Weather Conditions.** Arctic areas and cold weather conditions provide the surveyor with unique problems that must be overcome if the surveyor is to provide adequate survey control to the supported units. For the most part, arctic regions provide the same problems as cold weather conditions anywhere else. When committing survey teams to field operations in extreme cold, the effects of ice movement, snowfall, prevailing wind, light refraction, and other peculiarities must be considered. Cold weather operations are discussed in great detail in FM 31-70 and FM 31-71.

1. While the warmer seasons can provide the advantage of better visibility, personal comfort, and fewer equipment malfunctions, cold seasons can provide the advantages of reduced transportation difficulties in river, lake, and tundra regions. Survey control can be extended easily along riverbanks, over large bodies of water, or over the relatively level, treeless plains of the arctic tundra.

2. Equipment malfunctions increase in cold weather conditions.

a. The PADS operates without performance degradation at temperature extremes as low as -50°F (-45°C). Initialization will take longer when the temperature drops below -5°F (-20°C) or when wind blows into the IMU heat exchanger. The heat exchanger exhaust can be covered by a blanket or field jacket to help reduce heat loss. The vehicle heater should be used along with windbreaks to maintain an operational temperature for the PADS. PADS batteries should be stored in a warm place (above -20°F) when not being used.

b. Another planning concern when using PADS is that it is limited to operations between 75° north and south latitudes. Operations in arctic regions may force the use of GPS and conventional surveys.
c. The HCS can be stored without batteries, or risk of damage in temperatures as low as -4°F; however, the HCS will not operate in temperatures below 32°F, and any stored data will be lost at temperatures of -32°F or lower. The HCS must be maintained inside the user’s field jacket, against the body in cold weather conditions.

d. Optical equipment must be acclimatized prior to use in cold weather conditions. Temperature equilibrium will affect both the scales and optics of equipment. Optical equipment should be stored in an area with conditions as close to possible as those conditions in which they will be used.

3. Personnel must be trained in the use of cold weather equipment and cold weather field expedients.

4. Existing survey control in arctic regions is sparse to say the least. Locating existing control in arctic regions and cold weather conditions will take longer than in warm weather conditions. This is due in part to a lack of reference points to help identify or witness the stations as well as the need to dig through snow and ice to find it. Surveyors must understand that a pick and shovel can cause severe damage to a survey control point and that care must be taken when digging for control.

c. Desert Areas. A very large percentage of the world is covered by desert. Operations in desert regions are a common occurrence and these regions provide for there own unique obstacles for surveyors. While the open terrain and normally clear skies allow for long lines of sight and an abundance of celestial bodies for observation, other problems do exist.

1. The effects of wind blown sand and heat on equipment forces the surveyors to include those factors in the planning process.

a. The PADS operates without performance degradation at temperature extremes as high as 125°F (50°C). It may be stored at temperatures as high as 160°F without damage. Sand and dust will clog the PADS air vents and cause the PADS to quickly overheat. Covering the PADS to protect it from sand will have the same effect as the sand itself. Post operation maintenance including blowing the air vents clean is more important in desert regions than in any other environment.

b. Optical equipment must be shaded during leveling and protected from sand when not in use. Leveling vials increase about 2 graduations past true center in temperatures above 100°F and at temperatures reaching 120°F, leveling may be impossible. The most obvious obstacle to survey operations with optical equipment is heat waves. Eyestrain is more prevalent and instrument operator changes are more frequent. Observing long distances may not be possible. At those temperature extremes, survey operations using optical equipment should be avoided.

c. The HCS can be stored without batteries, or risk of damage in temperatures as high as 140°F, but will not operate in temperatures above 122°F. Any stored data will be lost at temperatures above 122°F. Additionally damage may occur to the LCD at 90% humidity with temperatures of 104°F or higher.

2. Personnel must be trained in desert operations. Noise and light discipline are more important in desert regions than other environments. Personnel should be trained in desert survival techniques since the time necessary to acclimatize is not normally available.

3. Existing control in desert areas, like arctic regions, is sparse and hard to locate. The lack of reference points and blowing sand will increase the time needed to locate these stations.

d. Jungle Areas. Jungle areas provide obstacles to surveyors such as heat, humidity, and a lack of adequate mapping products. Line of sight is a major concern in jungle regions, even for GPS operations, depending on the type of canopy.

1. Heat will effect the equipment in much the same manner as described for desert regions; however, the influence of humidity will increase the effects of heat on personnel and create fogging problems for optical equipment.

2. Maps for most jungle areas are inadequate except for coastlines, rivers, and roads.

3. Existing control will usually be located on mountaintops. This may preclude the use of PADS with those stations. Optical line of sight is a major problem for conventional teams, as is electronic line of sight for GPS teams.

e. Urban Areas. Survey in built-up or urban areas is restricted by line of sight, communications, the enemy situation, and accuracy.
1. PADS operations in urban areas may be the preferred method due to line of sight restrictions. Communications are also restricted due to the limited range of FM radios in built-up areas.

2. The tactical situation has a strong influence on survey operations in urban areas. The enemy can be well hidden in sewers, ladder wells, windows, on rooftops, etc. Enemy obstacles (i.e., mines, barricades, etc.) may deny the use of certain terrain or routes needed for the extension of survey through or around a built-up area.

3. Survey accuracy requirements in built-up areas may be increased due to the presence of the local populace. This is especially true when performing target surveys inside those areas.

4. Locations of installations are a concern in urban areas. OPs may have to be placed on rooftops, firing positions in airports, parks, or riverbeds. Reconnaissance and planning are essential for proper use of survey assets in urban areas.

5-8 Mapping, Charting, Geodesy

a. UTM Boundaries. The UTM grid system is bounded in the north at 84° N latitude and in the south at 80° south latitude. Beyond those boundaries, the UPS grid system is used with some overlap between the two systems. These systems are explained in detail in Chapter 3, Section II. Many fire support assets and survey computational devices do not provide for computations outside of the UTM system.

b. Nonstandard UTM Zones. These zones are found in the areas around Norway and Svalbard. Maps in those regions are made using the nonstandard zones; however, many fire support and survey systems do not recognize these zones.

c. Non-UTM Systems. Many areas of the world are mapped in systems other than UTM. Chapter 3 discusses some of the projection and grid systems that may be encountered. The surveyors may be required to develop UTM overlays of these areas. Also, existing control will be established in these systems; conversions to UTM will be required.

d. In many cases, mapping products and existing control will be of a different ellipsoid and datum combination than is prescribed in the operation order. Marine surveyors may be required to perform datum-to-datum transformations from the local datum to the operational datum as well as develop overlays and provide insight to datum problems and transformation accuracy. Chapter 2 discusses ellipsoids and datums.

5-9 Steps In Survey Planning

a. The steps for generating the survey plan/order can be found in the acronym BAMCIS. BEGIN THE PLANNING:

1. Review the Commander’s intent, scheme of maneuver, and the Artillery Fire Support Plan. This information is used in conjunction with Trig lists and intelligence information to develop maps and overlays that include survey control, current and planned firing positions, and fire support asset locations.

2. Enclosures 1 and 4 of the Artillery fire Support Plan describe targeting information and timelines for planned Artillery fires. These are used along with guidance from the Commander and S-3 to determine time requirements for providing survey support.

3. Priorities can also be established at this time, as to which installations or control will be surveyed first.

4. A warning order should be issued to the survey chief and party chiefs to allow for preparation of personnel and equipment to conduct the reconnaissance.

5. Using the information above and knowledge of the capabilities and limitations of the section’s personnel and equipment, make a tentative plan. Also perform a map recon and mentally walk through the tentative plan to ensure it will meet all requirements.

ARRANGE RECONNAISSANCE:

1. Once the tentative plan is formulated a thorough ground reconnaissance made. (If the time and tactical situation permits.)

2. The survey chief ensures the required personnel and equipment are prepared to conduct the reconnaissance.

3. The route of march, with check points, and a brief itinerary should be provided to the S-2 and S-3. This will allow for coordination with higher, lower, and adjacent units, ensuring safe passage of the teams involved. Consideration should be given to
challenges, passwords, and communications during the recon.

4. Coordination of the logistics requirements of the reconnaissance should be addressed to the S-4. Supplies, fuel, repairs, etc. may be provided by units located in or near the area to be reconnoitered.

5. Additional security requirements should also be requested through the battalion.

MAKE THE RECONNAISSANCE:
1. Only those Marines essential to accomplish the recon should accompany the survey officer. Limits should also be placed on the amount of equipment taken as well.

2. During the recon mission the survey officer should:
   a. Verify map data
   b. Determine validity of his plan
   c. Assess trafficability of routes
   d. Assess condition of terrain
   e. Note weather conditions
   f. Note changes to any intelligence information received from the S-2
   g. Make any changes necessary

COMPLETE THE PLAN:
1. Upon returning from the reconnaissance the Survey officer finalizes his plan. The survey order is written and briefed to the S-3. If time permits the survey plan is added to the Artillery Fire Support Plan. The S-2 is also briefed on any changes to the intelligence information he provided previously.

ISSUE THE ORDER:
1. The survey officer issues the survey order to the entire section in a 5 Paragraph Order. The order may be written or oral. (If given orally certain information should be provided to the survey teams separately, i.e. strip maps, trig lists.)

2. The order should be simple, direct, and thorough. All the information required to complete the mission should be given to allow for action in the absence of further orders. The order should describe what needs to be accomplished, and when. Priorities and accuracy are stated along with the methods to be used. Once the teams depart they must be able to use their initiative, and the information from the order to deal with the friction that is bound to occur.

3. Use of a terrain model and/or a map during the brief is of great importance for the Marines to visualize the mission and what is expected of them.

4. Time should be provided at the end of the brief for any questions that may arise. This ensures a thorough understanding of the mission.

5. Any acceptable deviations from current SOP should be specifically noted.

SUPERVISE:
1. Once the survey order has been issued, and the teams begin their portions of the plan, the Survey chief supervises conduct of the mission while the survey officer begins the planning process all over again, and coordinates with the S-3 concerning future operations.

2. As the current mission progresses and the situation changes, subsequent orders will be issued in the form of a FRAG. (The only required information being paragraphs 2 and 3, [Mission, and Execution] of the 5 paragraph order.) The survey chief must maintain close liaison with the survey officer and add to his situational awareness.

5-10 Survey Sketch

a. General. A survey sketch must reflect the survey order, and should be provided to the survey teams to ensure their portion of the survey mission is understood. This sketch should be as detailed as possible without hindering the flexibility and adaptability of the survey plan. The following items should be included in all sketches:

1. The sketch should be drawn to scale. Use a large-scale map or plotting chart for surveys covering large areas or to enlarge small surveys.

2. The sketch must be self-explanatory.

3. The sketch must show all known and required control. General locations (6-digit grids) can be used for required installations.
4. All points must be labeled.

5. A north arrow will be drawn for orientation purposes if a map is not used for the sketch.

6. Routes which must be taken for security purposes and restricted areas (i.e., hazards, obstacles, etc.) should be included on the sketch.

b. **PADS Operations.** For PADS operations, a detailed sketch is not always necessary. In many cases a strip map or route overlay that includes known and required control may suffice.

c. **Real Time Kinematic/On The Fly (RTK/OTF).** A sketch for an RTK/OTF roving team will be prepared in much the same way as that for a PADS team.

d. **Static GPS Survey.** A sketch for a static GPS network must include all stations in the network, not just the stations planned for that team. It will include prescribed routes and in some cases may include pre-planned observation times. Because of the large area covered by a static network, this sketch will generally be performed on the map sheet.

e. **Conventional Survey.** A sketch for a conventional survey must be more detailed than that for a PADS team. Other than the information listed above, the sketch should also include the following:

   1. Show all traverse stations.

   2. Show all horizontal angles, drawn from the rear station to the forward station.

   3. Starting and closing azimuths will be shown as a dashed line with an arrow pointing towards the azimuth mark.

f. **Security Of Survey Sketches.** The survey sketch includes a large amount of information that can be useful to the enemy. For this reason, the sketch must not be compromised; it must be destroyed if a serious threat of capture exists.