CHAPTER SIX

Management Processes and Skills

Management is about making the best use of available resources, including money, people, time and materials, in order to achieve designated goals. The management of engineering projects is a very broad and important field in itself. In this chapter we provide a broad overview of the field, and concentrating on the management processes and skills that are relevant to the work of planning and design. Of prime importance is teamwork and the full effective use of the skills of all individuals. Skills to manage oneself and also a team are discussed. The importance of personality characteristics of individuals and the roles individuals take in teams are also outlined. Skills that are required in managing day-to-day activities and provide the basis for undertaking many basic engineering activities such as planning, design and construction are also described. Managing conflict, time management and effective communication are skills for successfully undertaking an engineering project.

6.1 INTRODUCTION

This chapter addresses some of the concepts of *management* and outlines skills required by engineers to manage the resources of people and time. An engineering manager has to be capable of dealing with the processes related to the planning, design, construction and operation of engineering systems. At the same time the engineer's managerial responsibilities include the allocation of *human and financial resources* to enable tasks to be performed. Because of the nature of the engineering profession, engineers are members of teams and may take on management roles soon after graduation. Engineers therefore need to develop good communication and interpersonal skills in order to perform in teams and manage people. Throughout history many major engineering accomplishments have changed the way societies work. The design and construction of the Pyramids, the development of transport systems that crossed continents, the planning and construction of major dams such as the Hoover Dam and the Three Gorges Dam, the development of the space shuttle and of the personal computer are examples of engineering projects that are very different in their nature, but all have changed their societies. Such projects were undertaken using various leadership and management styles, varying from the one extreme of an autocratic and military nature to the *laissez faire* creative atmosphere in which personal computers were developed. While the management structures varied in these examples, the success of the project always rested on individuals with special skills who could work together in teams to achieve an effective solution using the resources at hand.

6.2 MANAGEMENT HISTORY AND PROCESS

The earliest management theories developed from the desire to manage workers and organizations more efficiently. *Engineering management* as a discipline has its origins in the industrial revolution of the 18th and 19th Centuries. During this period, cottage industries were replaced by large industrial organisations in the mining, minerals processing, manufacturing and construction sectors. In the late 19th and early 20th Centuries, engineers and managers attempted to develop a more rigorous approach to managing people, machinery and resources to achieve a defined end.

The discipline of Scientific Management commenced in the 1880s with the work of F.W. Taylor and the time and motion studies of Taylor and Gilbreth in the early 1900s. This was followed by Gantt's analysis of project management and the use of charts as outlined in Chapter 5 of this book. Henri Fayol (1841-1925), a French mining engineer, described management in terms of planning, organisation, command, coordination and control. Fayol's Administration Industrielle et Generale (published in 1916) was translated into English by Constance Storrs in 1949. From the translation, Fayol says "To manage is to forecast and plan, to organise, to command, to coordinate and to control. To foresee and provide means examining the future and drawing up the plan of action. To organise means building up the dual structure, material and human, of the undertaking. To command means maintaining activity among the personnel. To coordinate means binding together, unifying and harmonising all activity and effort. To control means seeing that everything occurs in conformity with established rule and expressed command" (Fayol, 1949). In 1913, Henry Ford adapted time and motion studies to the concept of an *assembly line* for the production of cars.

The Venetian Assembly Line

In the 1400s in the city of Venice, which was known for its naval production facilities, assembly-line techniques were used to fit out galley ships for war. A Spanish traveller in 1436 described the Venetians' process (George, 1968): "And as one enters the gate there is a great street on either hand with the sea in the middle, and on one side are windows opening out of the house of the arsenal, and the same on the other side, and out came a galley towed by a boat, and from the windows they handed out to them, from one the cordage, from another the ballistics and mortars, and so from all sides everything which was required, and when the galley had reached the end of the street all the men required were on board, together with the complement of oars, and she was equipped from end to end. In this manner there came out ten galleys, fully armed, between the hours of three and nine." This was an example of an assembly line 500 years before Henry Ford (George, 1968).

Shtub et al. (2005) defined *management* as "the art of getting things done through people." They identified the following seven functions of management: planning, organising, staffing, directing, motivating, leading and controlling. These activities are described in more detail in Table 6.1. The similarities to Fayol's list of management functions are obvious. The modern emphasis on motivating and

leading staff, as distinct from commanding them, should be noted. It undoubtedly reflects a more egalitarian perspective than that which existed in the early part of the 20th Century.

Max Weber described bureaucratic management in the 1920s and emphasized that order, system and rationality in management leads to equitable treatment for employees. Throughout the 1920s and 1930s an effort was made to understand human behaviour in the workplace through studies such as that led by Elton Mayo at the Hawthorne plant of Western Electric Co. (US). The workers were tested to see how their work environment affected their production. Many other human relations researchers contributed to the field, including Mary Parker Follett, Abraham Maslow, Kurt Lewin, and Renais Likert. In the 1950s, a further group of researchers including Douglas McGregor, Chris Argyris, Frederick Herzberg, Renais Likert, and Ralph Stogdill proposed behaviour theories. There was a mix of psychologists and managerial academics working on organizational development and restructuring in the 1960s and 1970s, including people such as Fred Emery and Peter Drucker (Ullman, 1986; McShane and Travaglione, 2003).

Table 6.1 Functions of management (adapted from Shtub et al. 2005).

Function	Description
Planning	Setting goals for the organisation. Identifying a course of action or plan that will lead to the achievement of these goals.
Organising	Assigning people and resources to activities, delegating appropriate authority and establishing a structure for reporting.
Staffing	Ensuring that appropriate human resources are available for the desired activities. Ensuring that adequate training and reward structures are in place.
Directing	Orientating staff and resources towards achieving the goals of the organisation.
Motivating	Encouraging individuals to achieve their best regardless of the tasks undertaken.
Leading	Setting an example for others to follow. Encouraging the development of group pride and loyalty.
Controlling	Monitoring performance relative to the plans. Taking action when the desired outcomes are not being achieved.

The development of understanding an organization as a system began in the 1950s, with an emphasis in this approach on explaining outputs in terms of transformed inputs, taking into account interaction with the surrounding environment. Ludwig von Bertalanffy, a biologist, developed a general systems model which contributed to this thinking. Other early systems contributors included Kenneth Boulding, Richard Johnson, Fremont Kast, and James Rosenzweig. Following World War II, a contemporary School of Management evolved which included Deming and Juran, who were the proponents of *Total Quality Management* which transformed many industries in both Japan and the United States.

The Contingency School of the 1960s emphasized that management processes were dictated by the unique characteristics of each situation. It was

resolved that the complexity of organizations was such that no single management strategy supplied the complete answer.

In summary, it has been seen that ideas on management have come from many different sources, with a range of tools proving to be useful for solving managerial problems. Over time it has been resolved that managerial actions must be decided on a situational basis. It is essential that organizations are considered as open systems and designed to consider individual needs for harmonious and continuing survival.

Human needs

All engineers require some management expertise to undertake engineering work. The planning, design and construction of projects, the innovative design of engineering systems, practical problem solving, managing operations of large engineering water and energy utilities and decision-making at all levels of an organisation require the management of the needs of a large number of individuals. Many engineers will work as project managers where the role is to manage people and resources committed to a project to ensure that it is completed on time and within budget. The needs of each individual in a project group affect the operation of the group, so much so, that the needs and tasks of both the individual and the group need to be considered together.

Intrinsically, under an optimistic view of life or the McGregor X style, it is assumed that individuals want to do their best (McShane and Travaglione, 2003). Research into what makes people work harder and achieve greater output was, and still is, of paramount importance to management in organizations. Maslow (1970) developed his Hierarchy of Needs, shown in Table 6.2, upon which many management researchers based their work.

Abraham Harold Maslow

Abraham Harold Maslow (1908-1970) was born in Brooklyn, New York, one of seven children born to his Jewish immigrant parents from Russia. His parents pushed him hard for academic success. He was lonely as a boy, and found refuge in books. Maslow's thinking was surprisingly original because he researched positive mental health. Maslow became the leader of the humanistic school of psychology, that emerged in the 1950s and 1960s, which gave rise to the idea that people possess inner resources for healing and growth (Public Broadcasting Service, 1998; Boeree, 2004)

"I was awfully curious to find out why I didn't go insane" - Abraham Maslow.

Maslow and researchers who followed developed models of the reasons for an individual's work behaviour. Note that these are only models and, in reality, human beings are very complex creatures who have many different aspirations that drive them. Maslow's theory suggests that, as a person satisfies one level of need, then behaviour is motivated to meet the next level of need. This theory has been built upon to explain people and organizational needs of today with various alternative variations of the five levels evolving. These models include Alderfer's

ERG (Existence Relatedness Growth) theory, Herzberg's motivator-hygiene theory and McClelland's learned needs, all of which are used to explain employee motivation (McShane and Travaglione, 2003).

Table 6.2 Abraham Maslow's hierarchy of needs (adapted from Maslow, 1970).

Basic Needs	Elements
Physiological	Food, air, water, sleep, comfort
Safety/Security	Physical, emotional security, fairness and justice, absence of threat, consistency and predictability
Social/Love and belonging	Love (both giving and receiving; separate from sex), affection, friendship
Esteem	Personal achievement, adequacy, confidence, freedom, independence, and the desire for reputation, prestige, recognition, appreciation from others
Self-Fulfillment (Actualization)	Realising a person's potential, basically satisfied people who expect the fullest creativity

6.3 WORKING IN GROUPS AND TEAMS

A *group* is a term which is vague in concept and can be any number of individuals who interact together. A *team* may be a group of people who work well together to achieve a common goal. Effective teams must have members who are willing and able to complete the task set, as well as work in a team environment. The size of effective teams has always been somewhat subjective because large tasks need large teams, but generally teams should be small enough to maintain efficient communication and coordination among the team members. Larger groups will always break into smaller informal groups to allow effective contributions from all members.

The three circles model of Adair (1983), shown in Figure 6.1, illustrates the three areas of needs in any group or team. Adair does not take credit for the model and its origin is unknown. It has been proposed (Johnson and Johnson, 2000) that one of the keys to human development has been the ability to form and work in small effective groups. Groups are central to much of human life and engineering is no exception.

Whether as a member of tutorial or practical groups as part of undergraduate study or as part of a large consulting firm working on multi-million dollar projects, engineering students and engineers will generally find themselves part of a group and in many cases will take, or be expected to take, a leadership role.

Effective groups are a force to be reckoned with; however, not all groups are effective and this can lead to significant problems. According to Johnson and Johnson (2000), an effective group

- achieves its goals (task);

- maintains good working relationships among members; and
- adapts to changing conditions in the surrounding organization, society and world.

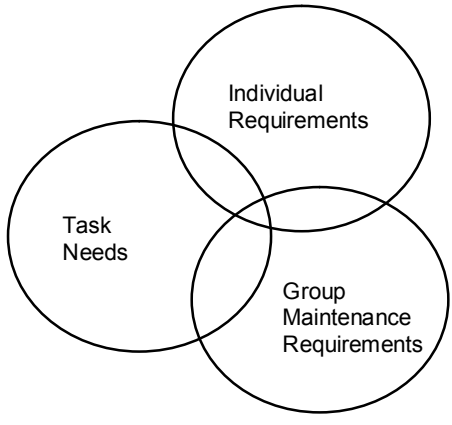

Figure 6.1 Three Circles Model (adapted from Adair, 1983).

What is missing here is attention to the needs of individuals in the group which is a factor that can make or break a group's activity. At present the trend is for more group work rather than less. A Fortune 1000 survey in 1993 found that 91% of companies had implemented some form of team working (up from 70% in 1987), and in Australia in 1991, 47% of manufacturing companies had employees in teams (up from 8% in 1988).

This means that engineers will not only work in groups and teams but in all likelihood take some form of leadership role in them as well, given that engineers are more likely to be in senior positions. For this reason it is important to know how teams work and, more importantly, to know what to do when they start to break down. Groups are often formed for a particular project and the members may not have worked together before. Members, therefore, can feel a little awkward with one another. Since the group will probably be working within a time limit, it is important for individuals to understand how groups function in order to improve the effectiveness of the team as soon as possible. This will be discussed in Section 6.6. Figure 6.2 shows some of the group activities undertaken in the problem solving processes and the interpersonal processes that involve group maintenance and self oriented behaviours.

6.4 LEADERSHIP

The question "What makes a leader?" has been posed many times. In business, sport, industry and academia there are facilitators, coaches, management academics and practitioners trying to explain a *leadership* concept that is broad enough to include leaders varying from Mohandas (Mahatma) Gandhi, Margaret

Thatcher, Elizabeth I, Joseph Stalin, Bill Gates, John F Kennedy, Martin Luther King, Mao Zedong, Nelson Mandela, John Monash and Aung San Suu Kyi. We will see later that different leaders have different personality styles.

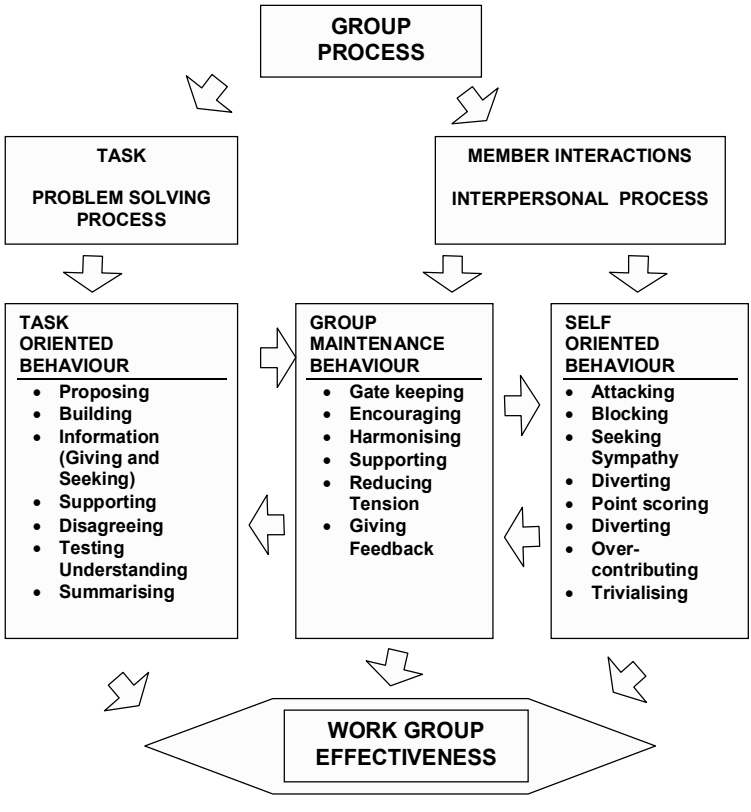

Figure 6.2 Behaviours undertaken for group effectiveness (adapted from Adair, 1983).

Developing leadership skills in the workforce is paramount to the success of organizations. Books, materials, training courses and conferences on the subject are plentiful. The challenge is to have the capacity to try out individual actions that improve the way things are done through development of an individual's style. Adair (1983) extended the simple three circles model for the functioning of groups and teams to show how leaders of teams need to function by maintaining processes in each of the three areas of task, group and self. The leader has the responsibility to ensure that all areas of need are addressed, the task is achieved, by building and maintaining the team and by ensuring the development of the individual.

Teams need a leader to succeed. An effort should be made to designate someone to play that role at or before the first meeting. Sometimes a person is appointed to the leadership role because of their place in the organisation. However, there is no need for that leader to be permanent and omnipotent. The

leader needs to ensure that the task and maintenance functions of the three circles model are performed. The roles of the members within the group can be decided by natural aptitudes for different functional roles or different people can be assigned to take on functions akin to their particular styles. Belbin (1981) outlined eight roles that any member of a group prefers to operate in, as shown in Table 6.3. This was later extended to nine roles with a specialist type added.

Table 6.3 The proposed team roles of Belbin (adapted from Belbin, 1996).

Type	Characteristics
Coordinator/Chairperson	Respected, mature and good at ensuring that talents are used effectively
Shaper/Driver	Dynamic and challenging, usually leads
Plant	Very creative, the ideas person
Resource Investigator	Extrovert, good at making outside contacts and developing ideas
Monitor Evaluator	Shrewd and prudent, analytical
Implementer	Practical, loyal and task orientated
Completer/ Finisher	Meticulous and with attention to detail, also full of nervous energy
Team Worker/Supporter	Caring and very person orientated
Specialist	High technical skill and professional, operates narrowly

The Coordinator /Chairperson takes the responsibility of keeping people on track, and pays attention to group processes. This person, with the help of the Team Worker/Supporter, ensures that all members participate and notices when someone is upset. However, it is apparent that when both a Shaper and a Coordinator work in a team, one of them has to adopt a secondary preferred role.

The Resource Investigator can also act as a person who serves as liaison between the team and the rest of the world. In the context of groups at university, this person interacts with the academic supervisor and other groups. We all learn from others but mostly from our own experience. It can be said that someone with a modest amount of natural ability, who works hard at observing the member interactions of group maintenance and self oriented behaviours, as well as the task and problem solving process, will forge ahead of a person of high natural ability who relies on instincts and never addresses his or her faults. To understand the principles of leadership and to work hard at them will ensure success. As Adair (1983) stated: “Good leadership is often so silent, so self-effacing, that you are hardly aware of it, but bad leadership always shouts at you.”

Laws of Leadership

A leader needs vision, discipline and wisdom (Newman, 1994). Vision shows that the leader knows what the long-term goal is and discipline is used to ensure that energy, time and resources are directed to achieve the goal. Wisdom can be considered to be the ability to apply knowledge and experience to any situation.

The leader also shows courage when different situations demand it. How does one create courage? The answer is as Mark Twain said: "Courage is a resistance to fear, mastery of fear—not absence of fear." To make some difficult decisions requires courage and this decision-making ability is an attribute that is needed by a leader. The leader empowers others to make decisions, as the team depends on all members contributing to the process of achieving the designated goal.

Friendships and humility are developed throughout one's career. Being a good listener and trusted confidante helps in mentoring the team, in avoiding rivalry and in producing the best outcomes. In each person's career there are times when it is necessary to have someone to open up to and ideally that person is the leader. No one survives alone. In developing such relationships a leader must exercise tact and diplomacy, and show impartiality. The leader must be prepared to learn from those within the team and those outside the team to produce the best outcome. Ideally a leader will exude inspirational power and enthusiasm and encourage team members to do their best. A leader's role is to serve the team so that the team will be able to say, "We did this ourselves".

6.5 BEHAVIOURAL STYLES OF INDIVIDUALS

One important consideration when thinking about groups and teams and how individuals can be melded into a team is the personalities of all members. There are many possible ways of classifying individual personalities. One way is according to the kinds of tasks that the person likes to take on: (leader, innovator, or keeper of the peace among many others). A search in the literature and the Internet can yield many free tests to discover what preferences of behavioural style an individual has. It is important to note here that there is no 'right' personality. The main task is to recognize the differences among team members and to work with the team members, rather than have them work against the team.

We will consider just two personality models from the many typologies that are available. The first, which has the advantage of simplicity, is called DISC, which is an acronym for: Dominance, Influencing, Steadiness, and Compliance. It parallels the writings of the Greek Hippocrates who established some terms in 370 BC for four temperaments: Sanguine, Choleric, Phlegmatic, and Melancholic. Plato in 340 BC also identified and labelled 4 categories: Guardian, Artisan, Scientist and Philosopher (McShane and Travaglioine, 2003). The second model is that based on Jungian theory and adopted by Isabel Myers and Katharine Briggs for their MBTI model, which now comes under other guises such as Keirsey's Temperament Sorter (Keirsey, 1998).

DISC behavioural styles

DISC follows a theory developed by Dr W.M. Marston in 1928 and further developed in the 1940s (Cole and Tuzinski, 2003). This theory suggests that a person's preferred behavioural style falls into one of four categories. Although all four styles will usually be displayed by a single person, one style tends to describe the person's behaviour better than the others. DISC does not measure skills,

experience, values, intelligence, beliefs or knowledge. DISC behavioural styles are shown in Table 6.4.

Table 6.4 DISC behavioural styles.

	Tasks and Results	Ideas and People
Direct Style	D: Direct, Dominant, Doer	I: Influencer, Inspired, Persuader
Indirect Style	C: Conscientious, Cautious, Critical	S: Steady, Supporter, Stable

The four styles are determined from whether behaviour is direct or indirect and whether behaviour is oriented towards tasks and results, or people and ideas. All styles are necessary and valuable. The descriptors help us to clarify differences in people and remove barriers to improve communication. By determining whether another person is direct or indirect, task-oriented or people-oriented, one can develop a better relationship and better communication with that person. Tests that can be used to assess behavioural style can be found on the Internet so that an allocation to one of Direct (Eagle), Influencing (Parrot), Supportive (Dove) and Conscientious (Owl) can be made.

Direct style? Faster or slower paced

Some people are direct and work quickly, take risks, are forceful, talkative and tend to make decisions quickly. The Dominant Director and Influencing Persuasive types fit into the category of direct styles, as shown in Fig. 6.3. The indirect styles are quieter, patient, cooperative, more cautious and easy-going.

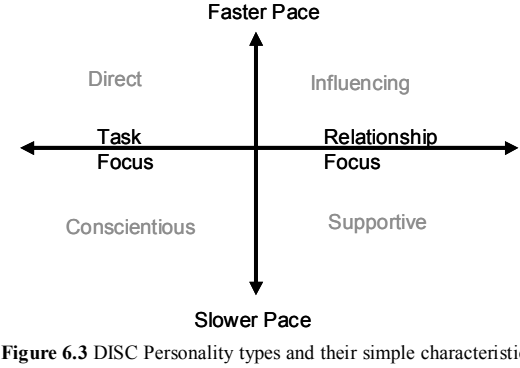

Figure 6.3 DISC Personality types and their simple characteristics.

They are good listeners and tend to take their time in making decisions and take fewer risks. Examples of indirect types include the Supporter and Conscientious styles.

People and ideas or tasks and results?

People who are relationship-oriented are generally open, appreciative and supportive, and find it easy to make friends. These people can be enthusiastic and can share their feelings. They tend to go with the flow in a relaxed manner. The Steady Supporter (S) and Influencing (I) styles stress people and ideas. They tend to promote harmony. The other types of people seem to be biased to task and results. This type likes structure, procedures, guidelines and facts. They prefer to get to the point and do not like their time wasted. They usually take a considerable time to show their warm side and tend to keep their feelings to themselves.

Note that no one operates entirely in one quadrant and we all tend to have a mixture of all the styles in different percentages. Each style has weaknesses and it is important to be aware of our own weaknesses so that we can improve in those areas. One style will be the dominant style of an individual, although in different situations other styles may well be used. Is the dominant style Direct or Indirect? Is there a preference for tasks and results, or people and ideas? Are people who have similar or different characteristics easier to get along with? Why?

Eagle (Direct)

The eagle personality is decisive and strong willed. Eagles are keen to get to the point and quickly. They are adventurous, take risks and are forceful. At work eagles are results orientated, but to be easier to work with, eagles should do more listening and improve their consideration of others. In various other typologies, this personality has been labelled as a Bear, Lion, Guardian and Controller.

Parrot (Influencing)

The parrot is enthusiastic and likes to express emotions. Parrots are talkative, optimistic and confident. In groups they are persuasive and gregarious. Parrots need to pay more attention to detail and improve their follow-through on tasks. In various other typologies, this personality has been labelled as a Monkey, Otter, Artisan and Promoter.

Dove (Supportive)

The dove is dependable, diplomatic, patient and a team player. Doves like to get results, are stable, good listeners and are sincere and patient. However, they could work at coping with change and improve their decision-making ability. In various other typologies, this personality has been labelled as a Dolphin, Golden Retriever, Philosopher and Supporter.

Owl (Conscientious)

The owl personality is orderly, cautious and reserved. Owls have high standards, are careful, analytical, diplomatic and accurate. They could, however, open up more and attempt to move out of their comfort zone if they are to make more impact on their team. In various other typologies, this personality has been labelled as a Beaver, Scientist and Analyst.

Myers-Briggs type indicator

In 1920 Carl Jung theorised that people were all different, having various degrees of four characteristic functions: Thinking, Feeling, Sensation and Intuition, and two attitudes: Introversion and Extraversion (Jung, 1923). He proposed that people's psychological orientation was formed by a dynamic mix of attitudes and functions. Isabel Myers used Jung's typology to establish a procedure for determining personality type in individuals and added the dimension of Judging and Perceiving to Jung's original typology. The Myers-Briggs Type Indicator (MBTI) was developed from decades of research by accumulating information on individuals' behaviour and attitudes of people in all spheres of work and life. The MBTI made available the theory of Jung to a much wider audience and was popularised through the 1980s and 1990s and is now embedded in many organisational management programs. A modified version has been developed by Keirsey and Bates (1984) and Keirsey (1998). Boeree (2004) has reviewed the work of Jung and has developed a questionnaire to map the elements of the MBTI as well, and this is freely available on the Internet.

The test has four scales. The first is the *Extroversion (E) – Introversion (I)*. This scale demonstrates how we interact with others. Overall about 50 percent of the population is extroverted and 50 percent introverted.

The second scale is *Sensing (S) - Intuiting (N)* with approximately 73 percent of the general population sensing and 27 percent intuitive. This scale shows our preference for how we deal with understanding the world either through step-by-step approaches, or through using vision and insight. A sensing person tends to assimilate a series of facts in a linear fashion, while the intuiting person absorbs the same information through conceptual jumps and development of patterns from abstractions. The S types dislike solving new problems without prior experience on how to solve them. On the other hand, the N types prefer to solve new problems and dislike carrying out the same thing over and over again. Of course, people tend to share both sets of qualities to some extent.

Thinking (T) - Feeling (F) is the third scale and these functions are distributed in a proportion 40 percent thinking and 60 percent feeling, with 60 percent of men being thinking types, while 70+ percent of women are feeling types. This scale is related to how we make decisions. This is the only scale that has a gender bias.

The last scale is *Judging - Perceiving (J-P)* and was included by Myers and Briggs to help determine the superior function of an individual. Judging people tends to be more cautious, whereas Perceiving people generally tends to be more spontaneous.

The Judging – Perceiving continuum also determines the superior function. Those people who have a "J" and are extroverts have the superior function on the thinking feeling continuum. Alternatively, extroverted and "P" means that the superior function is on the sensing feeling scale. An introvert deemed to be judging will have the superior function of senser or intuiter, while an introvert with perceiving will be superior on the thinking feeling scale. It has been found that J and P types are approximately evenly distributed throughout the population.

One function from each continuum is combined to identify a type represented by four letters such as ESTJ. Table 6.5 shows the various types for the general population and Table 6.6 the various types for engineers. The tables could be rolled

to make a cylinder which puts ISTP and INTP side by side and ESTJ and ENTJ side by side. We are more likely to favour the adjacent styles when not operating out of the main style. Each of the functions is a continuum, so situations will determine how much along that continuum we are likely to be.

Tables 6.5 and 6.6 suggest that engineers have a different personality profile from the general population and we find that most engineers are driven by thoughts and ideas, make decisions based on logic and facts, and tend to be organised and punctual (STJs). On the other side of the table, there are the more creative NTs who like to solve new problems, have an insight into the future and do not like routine. As with all these groupings, it is necessary to appreciate that different people see things differently, make decisions differently, interact with others differently and have different preferences.

Table 6.5 Myers-Briggs types summarised (% for general population).

Type Preferences	Sensing		Intuiting	
	Thinking	Feeling	Feeling	Thinking
Introversion Judging	ISTJ 11.6% Archivist	ISFJ 13.8% Devoted Carer	INFJ 1.5% Counsellor	INTJ 2.1% Builder
Introversion Perceiving	ISTP 5.4% Artisan	ISFP 8.8% Reticent artists	INFP 4.4% Idealist	INTP 3.3% Analyst
Extraversion Perceiving	ESTP 4.3% Negotiator	ESFP 8.5% Performer	ENFP 8.1% Enthusiast	ENTP 3.2% Pragmatic Politician
Extraversion Judging	ESTJ 8.7% Executive	ESFJ 12.3% Loyalist	ENFJ 2.5% Empathic leader	ENTJ 1.8% Visionary Commander

The % of each type comes from Myers et al. (1998)

Table 6.6 Myers-Briggs types summarised (% for engineers) (after Culp and Smith, 2001).

Type Preferences	Sensing		Intuiting	
	Thinking	Feeling	Feeling	Thinking
Introversion Judging	ISTJ 23%	ISFJ 5%	INFJ 2%	INTJ 14%
Introversion Perceiving	ISTP 6%	ISFP 2%	INFP 5%	INTP 6%
Extraversion Perceiving	ESTP 5%	ESFP 1%	ENFP 4%	ENTP 5%
Extraversion Judging	ESTJ 8%	ESFJ 4%	ENFJ 2%	ENTJ 7%

A fuller description of the Myers-Briggs types and characteristics are given in Appendix 6A and Appendix 6B.

Diversity – an important dimension of a team

"We know that a group of intelligent, motivated men and women of many different backgrounds and experiences makes an ideal engineering team. These individuals will see the world through different eyes and bring unique perspectives to the engineering task at hand. Their diversity will yield a diversity of solutions, which ultimately leads to the best solution." – *Dean of Engineering, University of Illinois at Urbana-Champaign (quoted in Daniel, 2002).*

When people talk of diversity, it is common to classify differences into a number of categories. These are

- professional - level of expertise, career stage;
- demographic - gender, age, nationality, language;
- psychodynamic - attitudes, personality type, sexual orientation;
- physiological - energy level, health; and
- world view - values, tendency to prejudice, tendency to bias, ethics stance.

As an example, the Adelaide Car Component Company had a workforce with the following statistics:

- 1160 employees;
- 58 managers, 161 professionals, 80 sales and service, 861 on shop floor;
- 71 percent male, 29 percent female; and
- 52 ethnic groups.

One would expect diversity based on professional, demographic, psychodynamic, physiological and world view – in fact over all categories. There is a tremendous potential here for great things (and for disasters!). A characteristic of teams with diversity is that they are susceptible to splitting into subgroups along gender, ethnic or other dimensions (Lau and Murnighan, 1998), but they do have the capability of having a great synergy to get better solutions to problems.

6.6 GROUP AND TEAM DEVELOPMENT

Many common-sense strategies for working in groups are now discussed and, if used in conjunction with knowledge of the stages of *team development*, can assist in moving the team forward.

Getting to know other group members

This appears to be elementary, but many groups never get to know the other team members. Generally, different team members have very different values, motivations, abilities and personalities. The first thing to do as a group is to make sure everybody introduces themselves. Make sure everyone has written down all other members' names. Suggest that everyone uses each person's name once at the initial meeting. Many people will immediately forget names if heard once or never quite hear them the first time. Ensure that everyone gets each other's name (and do not be afraid to ask for the spelling). Following this, get to know what they like doing, where they are from, show interest and generally find out about them. Some members will be totally involved and others will be apathetic if they are allowed to

be. Try not to let people remove themselves from the group because they then become dead weight, leading to frustration and resentment in some group members.

Something that is hard to accept is that when team members do not participate it is not entirely their fault. It is also the fault of the leader and all other team members. One cannot be responsible for all team members all the time but some simple skills will enable fuller participation by all.

Our style and approach is adapted to the situation, depending on whom we are dealing with; from being patient to being very direct. The key to our understanding is knowing those we are dealing with, and learning to change our individual style so that better understanding is achieved. While each person has a dominant style of interaction it can be advantageous to understand each others' styles and to adapt when necessary. Keep a watch on the process and practise this skill.

From the MBTI we know that approximately 50 percent of people are introverted. These people find it against their nature to immediately talk in a group situation as they find it stressful. They tend to think things through before talking. Some people consider others' feelings and will not tell them when they have made mistakes. In a group with many extroverts, the introverted person will find it difficult to participate. To speak up to gain attention is not in his or her nature. It is the extrovert's responsibility to make an effort to include the introvert, to not dominate the conversation with them, and to not take the floor away from them. If the team wants to succeed, the team must actively manage the process of inclusion of others.

Stages in team development

When teams come together to undertake a specific task, it has been found that they tend to go through a series of quite well-defined stages. In 1965, Tuckman developed a model that had four stages of forming, norming, storming and performing. Some stages are very productive, some less so. It is important to realise that this is standard behaviour and that, if one is part of a group, these are the different stages that should be expected to happen and need to be worked through. Two extra stages of pre-group and adjourning can be added, as shown in Figure 6.4 and described below.

Stage 1 – Pre-group

At this stage the task is usually broadly defined, the group is undefined, the resources are undefined and there might appear to be little that anyone can do. However, there is. Members can decide on commitment at this early stage, and show it by, for example, arriving on time, or behaving in a way that demonstrates their willingness to be part of the group.

Stage 2 – Forming

As the groups are formed, inclusion or exclusion is of paramount importance as members try to work out their place in the group. There may be superficial conversation and people orientate to each other and the task. It is suggested that

even at this early stage there will be a search for direction and people will be looking for someone to provide strong leadership. The culture of the group is established during this stage. When teams are beginning, each member considers his or her identity within the group. Identity can be considered to be a combination of personality, behaviour, competencies, and position in the social structure of the group (Borgatti, 2002). Certain members will fight for dominance, others will like to be seen as being smart, others will play a comedian role, and some just want to be liked. Knowing Belbin's roles helps a team through this stage by allowing the preferred styles of individuals to be incorporated in planning roles for the group by the leader.

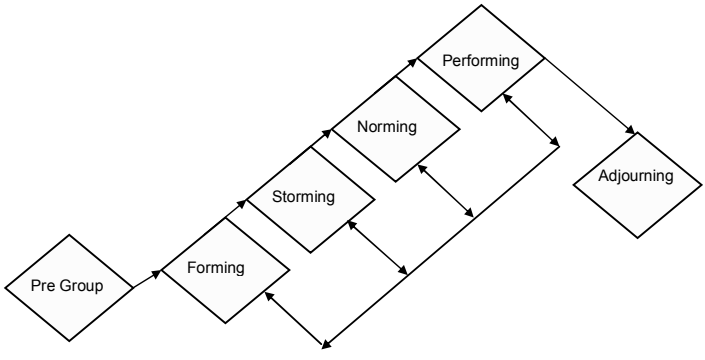

Figure 6.4 Stages of group development.

Stage 3 – Storming

Once the initial nerves are overcome, it is time for people to be confident enough to cause trouble! There may be the first conflict with personal agendas revealed. The interactions between members may be quite uneven and there is the tendency to rebel against the leader. The interactions allow a pecking order to be established. It is important to resolve conflict, otherwise apathy can set in, and doubts may surface about the ability to cope with the task.

Stage 4 – Norming

Following the early disruptions, there may emerge a sense of renewed hope. Members can become more tolerant of each other and cohesion increases, and harmony becomes important. The roles of the members are established and they can become less dependent on the leader, although the leader is still necessary.

Stage 5 – Performing

The group then enters its most productive phase. Members 'get on with the job', although minor problems may still occur. The role of the leader has changed and he or she is now seen as a peer and resource person. The roles have all been determined and there is consolidation of the status hierarchy.

Stage 6 – Adjourning

The final stage of the team is its disbandment. As things wind down, there is time to check that the goals have been achieved and to try and cope with the end of the group. Many will make plans for future meetings and there may even be some sadness. Most importantly, there will often be a level of excitement based on what was achieved.

As teams evolve, if new members join the group, there is a tendency to revert to an earlier stage of development. This can be seen in Figure 6.4 where a number of cycles are generally needed, especially if all members do not attend meetings or carry out the work allocated to them. It is important that teams assess their performance from time to time. Most teams start out well, and then drift away from their original goals and eventually fall apart. This is less likely to happen if, from time to time, the team facilitator or leader asks everyone how they are feeling about the team, and does a public check of the performance of the team against the mission/vision statement.

6.7 TEAM MEETING SKILLS

The skills required by an engineer are many and varied. These include the management of time and people. Managing people requires the manager to know his or her inner workings. Once an individual knows how others see him or her and how he or she interact with others, he or she will become better in leading groups and teams. Managing the resources that are available is paramount for any engineer carrying out projects. The ability to facilitate meetings and to manage one's own time are two skills that are part of being an efficient manager and leader. Meetings can be useless if there is no control of the discussion.

Effective Meetings

To have effective *meetings*, it is important to set an agenda, start and finishing times, the location for the meeting and ensure the chairperson keeps control of the process and time schedule. One simple thing that helps a lot is having an agenda. Brainstorming sessions have their own format. Meetings should have a designated outcome but if the meeting is just for a one-way distribution of information, this can be done prior to the meeting and the *agenda* set for discussion. Some simple processes are

A **Attendees assign a chairperson** who should encourage active participation to have the best possible decision-making process. Remember the meeting is for the benefit of all attendees. Listen to other points of view and do not be afraid to offer your own opinions.

G **Group dynamics** are important to allow all members to have a say. Ensure quieter members contribute, as they often have excellent ideas. Be firm with dominators who talk all the time, not allowing others to contribute. Remember the goals of the meeting.

E **Expected outcomes are achieved** by explaining the purpose of the meeting, exploring ideas and allowing all members to contribute to the discussion. Each member should feel that a contribution is expected and will be valued.

N **Note-taking for an accurate record of the meeting is essential.** This is a skill to practise and apply in meetings. The more that one does note-taking, the more adept one becomes at it. Rotating the position of the official recorder of the meeting is important for all members to get experience.

D **Designate an action against each item.** Decide "who is doing what" by what date so that everyone is clear on what is required. Create an action list.

A **Announce and advise** what is on the designated **Action** list, by circulating the minutes of the meeting as soon after the meeting is completed and set the next agenda, including time and place! The first item on any agenda should be a "status check," which is where the facilitator asks each person how things are going and whether actions have been undertaken and, more importantly, whether there is anything that needs to be discussed.

As an individual attending a meeting, check the contribution that can be made by asking: Should this be a brainstorming session? See guidelines on brainstorming and creativity in Chapter 4. What preparation is required for the meeting? Has the work that has been allocated on the action list been completed? Are there other members who were not at the meeting who need to be involved?

Some goals that successful chairpersons try to undertake are to establish the vision in conjunction with the group; ensure the team focus on the task; actively pursue participation from all members of the team; protect individuals from direct personal attack and establish conflict resolution strategies; suggest alternative processes when the team is stalled; and summarize and clarify the team's decisions. The chairperson accomplishes these goals by doing the following:

- Stays neutral and ensures that good seating arrangements are used (e.g., best in a circle);
- Keeps the meeting on time, even if it is going well (or people will try to avoid coming next time);
- Expresses out loud what seems to be happening (e.g., "George and Paul (in a side conversation) can you please give your opinion on the issue at hand"; "nobody seems to be saying much since Belinda suggested ... ");
- Ensure conflicts, snide remarks and put-downs are addressed immediately to help foster a team spirit even referring the perpetrators to reading material on group behaviours; and
- after a person has not contributed for a while, ask for his or her opinion.

Most importantly, before it is decided that a meeting needs to take place, examine if there is a better method to achieve a similar outcome. Email, telephone and/or video-conferencing may be more efficient alternatives.

Handling conflict in teams

Too much conflict may be a bad thing, but some is considered good because it may lead to more ideas being considered. The important issue in conflict is to ensure it is controlled and does not get out of hand. Correct decisions need to be taken if a wrong engineering decision will lead to a bad outcome, even if this is bad for team morale. This is not as easy as it sounds because there are many sources of conflict, many different situations in which it occurs and therefore many different ways of handling it. The five ways of handling conflict shown in Figure 6.5 depend on the behaviour and attitude of the person causing the conflict, and the managerial style of the person attempting to resolve it. These will now be discussed in a little more detail.

Coercion

With coercion the leader essentially imposes his or her will on the person who has caused the conflict. It is a power-orientated approach and is useful if quick action is needed, or for unpopular decisions. While it works well in these situations, it may cause problems later because, although quashed at the moment, the conflict may not be resolved and the losers may become angry because there is competition for their own concerns. At this point, a negotiated resolution becomes less likely.

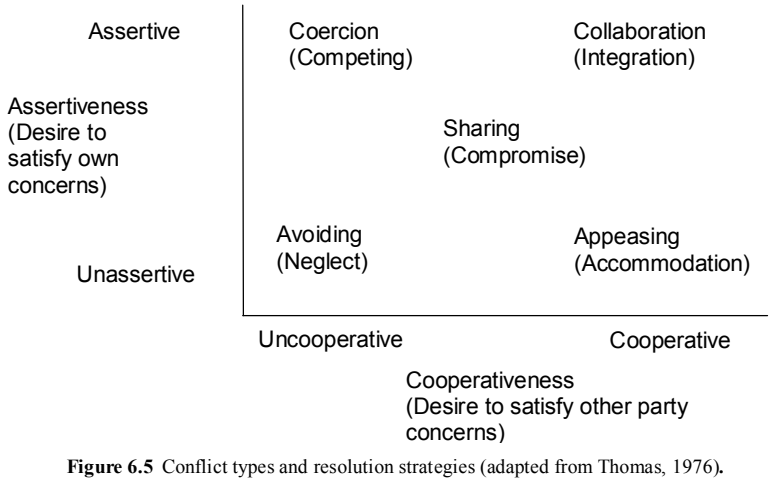

Figure 6.5 Conflict types and resolution strategies (adapted from Thomas, 1976).

Accommodation

In accommodation, an unassertive leader works with a cooperative team member. Both neglect their own needs to suit others (to a certain extent). It is a useful conflict strategy if a team needs to preserve harmony, or when one of the two realises he or she is wrong. It has the advantage in that it allows others to learn by their mistakes, and is useful in building credit for later. On the down side, because they have given way, the feeling of self-worth may be diminished, and winners may press for further domination.

Avoidance

Conflict from an uncooperative team member can also be handled by avoiding the issues altogether. Avoidance does not address the conflict directly but sidesteps and attempts to postpone any resolution. As a strategy, avoidance is useful when the issue is trivial, or the leader's power is low. It may also be applicable when the potential damage is greater than the benefits of resolution, or if there is a need to allow people to cool off. On the other hand, it generally gives low satisfaction and may even increase the opponent's frustration.

Compromise

Compromise seeks a mutually acceptable solution to the problem, or at least a temporary solution. It can be used where two opponents have equal power, or to achieve a temporary settlement in complex matters, or when goals are only moderately important. The main disadvantages with it are that the conflict is thought likely to re-emerge, and both sides may be dissatisfied with the outcome.

Collaboration

If there is time, working together using successful negotiating behaviours can bring an excellent result to conflict. Collaboration can be used to find a solution when both parties' concerns are too important to ignore, to maximise commitment, and when it is important to learn from others. It can, however, take time and energy to work through it.

Elephants and ants analogy for choosing priorities

If ants were on the menu for dinner, how many would be needed for a feed? A great many! A lot of hunting would be required. On the other hand, if an elephant was on the menu for dinner how many would be needed? One would satisfy everyone's appetite.

The activities that we perform in our daily lives can be related to the elephants and ants analogy. When work is about killing ants there is a confusion of activity with accomplishment. What kind of sustenance would be obtained from a large number of ants? Choosing to carry out easy small tasks is done because they can be done quickly, so as to achieve the illusion that a lot has been accomplished, when in reality productivity has been poor. One falls further and further behind because the elephant hunting has been overlooked.

Elephant hunting or focussing on high payoff activities leads to productivity in the longer term. If one is busy stomping ants all day long, then the elephants will be totally ignored.

If the situation exists of constantly being busy, spending time answering unimportant emails or dealing with minor interruptions, then there is a need to change from these "ant stomping tasks" to work on higher payoff activities. The ants still need to be dealt with but at a lower priority and with less time allocation. Try to spend less time with ants each day. **Don't Confuse Activity with Accomplishment**. (Adapted from Vance, 1993)

6.8 PERSONAL TIME MANAGEMENT SKILLS

Vilfredo Pareto (1848-1923), an economist, made the well-known observation in 1906 that 20 percent of the population owned 80 percent of the property in Italy which was later generalised into the so-called Pareto Principle (for many phenomena, 80 percent of consequences stem from 20 percent of the causes). This principle was further generalised in 1937 by Joseph Juran (1904-2008), the quality management guru of the 20th Century. Applied to time management, this translates to 20 percent of the time being expended on "the vital few" situations or problems to account for 80 percent of the results.

People can waste much time if they do not have direction or know how to recognise what is important. Time is irreversible and can never be regained. Engineering managers and leaders have many demands in any one day, and therefore time is required to be managed to ensure effective use of it.

Vance (1993) emphasises the need to focus on important activities rather than activities which just keep everyone busy and being reactive to distractions or so-called urgent needs. This is also the basic premise of Covey (1989) in "The Seven Habits of Highly Effective People". The quick way to improve work productivity, family and social activities is to identify the 20 percent of the activities that will reap 80 percent of the benefits. It is necessary to reduce the time allocated to activities which give us small benefits, the so-called "ants". Table 6.7 lists some possible time wasters suggested by Richards (1982).

Table 6.7 List of time wasters.

Waiting	Travel
Attempting too much at once	Unrealistic time objectives
Lacking objective/priorities and planning	Telephone interruptions/conversations
Inability to say "No"	Indecision
Jumping in	Bureaucratic processes and form filling
Lack of self-discipline	Television watching/DVD
Internet/computer games	Idle conversations
Failure to listen	Poor organisation/filing system
Duplicating effort from not finishing	Unanticipated interruptions or visitors
Communication problems with others	Ineffective meetings
Micromanagement/too much supervision	Environment with visual/noise distractions
Confused responsibility	Doing urgent rather than important tasks
Other……	Other……

Source: (adapted from *"The Executive's Guide to Modern Management Skills"* by Richards, 1982).

Procrastination

One must overcome the state of mind that is procrastination, which is the delaying of planned activities. What we have to do in most cases is just get started—make a plan and do it. Do not make excuses for putting off doing activities or even not planning to do them at all. Analyse how time is spent, for example, by jotting down what is done for a week for each quarter of an hour, and then implement a few methods to eliminate the identified bad habits that will gain the most time.

Rank these according to level of importance. Do this so that there are four groups of three activities. Once this has been done, undertake actions to operate on the top three as a priority, to help manage time.

First of all, we need to allocate time to important tasks rather than urgent but unimportant tasks. This can be achieved by developing a plan with priorities which is updated along with a daily to-do list and weekly and monthly goals. To accomplish good time management needs self-discipline. This will require changing old habits and developing new ones. One has to be persistent in using the time saving hints developed in the time management plan. Once plans are put in place and gains in time have been achieved, the next areas for review can be considered.

A Simple Time Management Plan

Effective time management at work is crucial to accomplishing tasks and goals, so that there is personal time left for personal enjoyment. Organization and task focus are the primary requirements. There needs to be persistence and self-discipline, an awareness of overcoming procrastination and a long-term vision.

- **Plan activities**. Take time to plan activities. It is important to allow time to plan wisely. Establish priorities for the day, the week, short-term, mid-term, and for the long-term. **Dividing large tasks** into a series of small manageable tasks will let the large task be easily accomplished. Each small task should have a deadline.
- **Set time aside to do high priority tasks.** Maintain accurate calendars; abide by them and adjust priorities as a result of new tasks. This can be done by using checklists and to-do lists and in some cases doing the most difficult task first.
- **Do one task at a time, if possible.** When starting a task, try to complete it before starting another task-this can be done by allocating enough time for the task.
- **Set start and stop times for activities.** This will need estimates, but these will improve with practice. Challenge the theory, "Work expands to fill the allotted time." Therefore, establish deadlines for all tasks. Ensure meetings have a specified purpose, have a time limit, and include only essential people. Do not waste other people's time.
- **Do it, delegate it, and dump it.** (Vance, 1993) Do not put unneeded effort into tasks and activities which do not require perfection. Handle correspondence quickly with short letters and memos. Save time for other activities. Learn to know when to stop a task, using the Pareto Principle. Delegate as much as possible and empower subordinates. Throw unneeded things away.
- **Learn to say no.** By making the mistake of saying yes to too many things, priorities are then decided by others.
- **Avoid committing to unimportant activities, no matter when they are.** Ask what can be planned for this time slot, such as a holiday, a weekend hiking or camping or a fun weekend with family.

- **Get Started.** The classic time waster is avoiding starting a project. The most important item is to do it now. "A journey of a thousand miles starts with one step."-Lao Tzu. The ability to start work quickly results in achievement and satisfaction. Five minutes now can achieve the start and the journey is begun. Give rewards for finishing tasks, as this tends to stop procrastination and helps starting.
- **Develop a routine** to do certain tasks like answering emails when there is time but not the energy to do other tasks. Set aside time for reflection.

Time Management—Long-Term Goals

Keep long-term goals in sight. Have checklists with items such as: "department meeting at 2:00" and "ring so and so, write letter/memo on…," but ensure time is put aside for the relationship tasks. Other examples include:

- meet with staff on a regular basis both formally (interviews) and informally (morning coffee at least once a week);
- develop a plan for the organisation to use only recycled paper;
- enroll to study Italian because in 4 years I want to be fluent because (insert your goal); and
- exercise each day (e.g., at least 15 minutes walk no matter what the weather).

Planning

As a planner, memorising this poem of Rudyard Kipling (1865-1936) will assist in developing a focus on the crucial facets of any plan. In planning, responses need to be made to each of these questions. (Adair, 1986)

I keep six honest serving-men
(They taught me all I knew);
Their names are What and Why and When
And How and Where and Who.
I send them over land and sea,
I send them east and west;
But after they have worked for me,
I give them all a rest. (From *The Elephant's Child*)

Try not to get caught up in short-term demands which put pressure on things that are more important that one should be doing but cannot find the time for. Approximately 30 percent of items on the "to-do list" should be long-range items that would normally be put aside for when there is enough time! These long-term goals are very much embedded in students earning a degree but also goals for fitness, exercise and sports, relaxation and enjoyment need to be developed. Spontaneity can be fun, but make sure that there is time available for the things which will enable long-term goals to be accomplished.

6.9 SUMMARY

The resources of time, money, materials and people are used to make things happen. In this chapter the need to manage people and time has been addressed. First of all, learning how to manage oneself can make it easier to manage others. To manage others it is imperative that one manages oneself in a way that promotes the desire in others to do well. In this way teams and groups will achieve desired outcomes and some fun may be had along the way.

As an engineer, you will not only work in groups and teams but in all likelihood take some form of leadership role as well, as many engineers rise to senior positions. The importance of knowing how these roles work and, more importantly, to know what to do when they start to break down cannot be stressed enough.

It has been shown that effective time management is crucial to accomplishing tasks and goals as well as providing time for personal activities.

PROBLEMS

6.1 Write down five groups/teams that you have been part of in the last year and determine if they were really a group or a team. Is it possible to classify them easily or are there elements of both in some of them?

6.2 Break into groups, as designated by lecturer. These can be groups of different sizes ranging from 3 to more than 10. Discuss "What are the important elements of having a successful meeting?" Prepare a set of hints for running meetings.

6.3 Use the results of the personality test (http://www.keirsey.com/) to assess the attributes of the people in an engineering group project that you are involved in. What are the advantages of doing this in a formal way?

6.4 Working with an engineering project group of which you are/were a member, list the range of diversity that the members exhibit. Take some care with this because, due to cultural differences, some may not be happy to discuss various aspects of themselves. You may find sexual orientation is one area that, quite reasonably, many are keen to avoid discussing, and this should be taken into account.

6.5 In groups where you are involved through the year, make a careful observation of conflict and how it is resolved. Are there people who seem to always want to use the same resolution strategy no matter what the situation? Does this work?

6.6 Irrespective of the nature of the conflict or the feelings of the leader, what strategies of conflict resolution might be appropriate for a problem that arises on the day before a report is due?

6.7 Choose three of the leaders listed in Section 6.4, and find out what their main attributes of leadership were against the 10 leadership laws.

6.8 Activity for group review: assess what might be going wrong in your team and think how to remedy it.

How is the group functioning?	**Score from 1 to 7: 1 is agree, 4 is sometimes, 7 is disagree**
Group clarifying what the task or objective is	
Group continuously checking on progress against timeline and seeks reasons for non-compliance	
Group clarifying or recording what has been decided	
Group clarifying who is going to do what	
Group clarifying what has to be done by when	
Group establishing procedures for handling meetings	
Group keeping to agreed procedures	
All members listening to each other	
Not allowing individuals to dominate and others to withdraw	
Not compromising individual needs for the sake of the team	
Group recognising the feelings of members of the team	
Members contributing equally to the progress of the team	

Sum the 12 scores. A score of 12 would be perfect, 12 to 29 shows team is working well, 24 to 50 requires more effort, 50 to 84 would be disastrous and requires a meeting to change attitudes in the group.

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APPENDIX 6A THE MBTI DESCRIPTIONS

The following list comes from a number of sources including Keirsey and Bates (1978), Keirsey (1998) and Boeree (2004).

ENFJ (Extroverted feeling with intuiting): Mikhail Gorbachev, Mao. These people are the conversationalists of the world. They tend to idealize their friends. They make good parents, but have a tendency to allow themselves to be used. They make good therapists, teachers, executives, and salespeople.
ENFP (Extroverted intuiting with feeling): Leon Trotsky. These types of people love novelty and surprises and tend to be imaginative. They are big on emotions and expression. They tend to find reasons to do whatever they want. They tend to improvise rather than spend time preparing. They are good at sales, advertising, politics, and acting.
ENTJ (Extroverted thinking with intuiting): Bill Gates, Margaret Thatcher, Napoleon Bonaparte. In charge at home, they expect a lot from spouses and kids. They like organization and structure and tend to make good executives and administrators.
ENTP (Extroverted intuiting with thinking): Richard Feynman, Walt Disney and Nikola Tesla. These are lively people and tend to be outspoken, not humdrum or orderly. As mates, they are a little dangerous, especially economically. They are good at analysis and make good entrepreneurs. They do tend to play at one-upmanship.
ESFJ (Extroverted feeling with sensing): Michael Palin. These people like harmony. They tend to be very active committee members and work best with encouragement and praise. They may be dependent, first on parents and later on spouses. They wear their hearts on their sleeves and excel in service occupations involving personal contact.
ESFP (Extroverted sensing with feeling): Picasso. Very generous and impulsive, they have a low tolerance for anxiety and are sometimes labelled as performers or artisans. These people like public relations, and they love the phone. They tend to know what is going on and join in eagerly.
ESTJ (Extroverted thinking with sensing): Joseph Stalin, Harry S. Truman. These are responsible mates and parents and are loyal in the workplace. They are realistic, down-to-earth, orderly, and love tradition. The majority of engineers fall in this category. They often find themselves joining civic clubs!
ESTP (Extroverted sensing with thinking): Theodore Roosevelt, Henry Ford. These are action-oriented people, often sophisticated, sometimes ruthless - our "James Bonds." As mates, they are exciting and charming, but they have trouble with commitment. They make good promoters, entrepreneurs, and con artists.
INFJ (Introverted intuiting with feeling): Carl Gustav Jung, Mahatma Gandhi. These are serious students and workers who really want to contribute. They are private and easily hurt. They make good spouses, but tend to be physically reserved. People often think they are psychic. They make good therapists, general practitioners and ministers.
INFP (Introverted feeling with intuiting): Albert Schweitzer, Audrey Hepburn. These people are idealistic, self-sacrificing, and somewhat cool or reserved. They

are very family and home oriented, but do not like to relax. These people are found in psychology, architecture, and religion, but never in business.
INTJ (Introverted intuiting with thinking): Stephen Hawking, Dwight Eisenhower, Isaac Asimov. These are the most independent of all types. They love logic and ideas and are drawn to scientific research. They can be rather single-minded.
INTP (Introverted thinking with intuiting): Albert Einstein, Marie Curie. Faithful, preoccupied, and forgetful, these are the bookworms. They tend to be very precise in their use of language. They are good at logic and mathematics and make good philosophers and theoretical scientists, but not writers or salespeople.
ISFJ (Introverted sensing with feeling): Mother Teresa. These people are service and work oriented. They may suffer from fatigue and tend to be attracted to troublemakers. They are good nurses, teachers, secretaries, general practitioners, librarians, middle managers, and housekeepers.
ISFP (Introverted feeling with sensing): Mozart, Auguste Rodin. They tend to be shy and retiring, not talkative, but like sensuous action. They can be good at painting, drawing, sculpting, composing, dancing and they like nature. They are not big on commitment.
ISTJ (Introverted sensing with thinking): John D. Rockefeller. These people are dependable pillars of strength. They often try to reform their mates and other people. They make good bank examiners, auditors, accountants, tax examiners, supervisors in libraries and hospitals, business and boy or girl scouts! Engineers are a greater proportion than average in this category.
ISTP (Introverted thinking with sensing): Michael Jordan, Lance Armstrong. These people are action-oriented and fearless, and crave excitement. They are impulsive and dangerous to stop. They often like tools, instruments, and weapons, and often become technical experts. They are not interested in communication and are often incorrectly diagnosed as dyslexic or hyperactive.

APPENDIX 6B THE MBTI DIMENSIONS

This list is compiled from Keirsey (1998); Ancona, et al. (1999); and Borgatti (2002)).

Interacting with Others (E/I)

Extraverts	**Introverts**
Prefer variety and action	Prefer working alone without interruptions
Communicate freely	Prefer quiet for concentration
Often impatient with long, complicated jobs	Tend not to mind working on one project for a long time uninterruptedly
Like having people around	Are interested in the ideas behind their work
Are interested in the activities of their work and in how other people do it	Tend to think before they act
Are often impulsive	Develop ideas by reflection
Develop ideas by discussion	Dislike intrusions and interruptions
Like greeting people	No strong need to meet regularly with others
Learn new tasks by talking and doing	When speaking publicly, will prepare in depth and speak from a plan
Enjoy meeting new people	Consider consequences before acting socially
Seek out social gatherings	Sometimes have problems communicating
When speaking publicly, will often improvise	

Understanding the World (S/N)

Sensing	**Intuition**
Prefer practical problems	Dislike doing the same thing over and over
Prefer established systems and methods	Like solving new complex ambiguous problems
Like using experience and standard ways to solve problems	Are impatient with routine details
Enjoy applying what they have already learned: like to work with tested ideas	Like to float new ideas
May distrust and ignore their inspirations	Enjoy learning a new skill more than using it
Seldom make errors of fact	See possibilities and implications
Like to do things with a practical bent	Tend to follow their inspirations
Like to present the details of their work first	May ignore or overlook facts
Prefer continuation of what is, with fine tuning	Like to do things with an innovative bent
Usually proceed step-by-step	Have creative vision and insight
Patient with routine detail	Like to present an overview of work first
Like to have schedule for working	Prefer change, sometimes radical, to continuation of 'what is'
Search for standard problem solving approach	Usually proceed in bursts of energy
	Like innovative approaches

Making Decisions (T/F)

Thinking	**Feeling**
Try to establish objective decision criteria	Personal subjective decision criteria
Measure decisions against payoffs	Measure decisions against beliefs
Can be seen as hard hearted, detached and cold	Can appear overcommitted to a point of view
Decide according to situation	Believe in deciding on personal considerations
Tend to relate well only to other thinking types	Nostalgic
Negotiate on the evidence	Negotiate on rights and wrongs of issues
Concern for fairness based on rules	Fairness comes from values and beliefs
Like analysis and clarity	Like harmony based on common values
Situation oriented	Objectives emerge from beliefs
Use logical analysis to reach conclusions	Principles oriented
Want mutual respect among colleagues	Use values to reach conclusions
May hurt people's feelings without knowing it	Want harmony and support among colleagues
Tend to decide impersonally, sometimes paying insufficient attention to people's wishes	Enjoy pleasing people
Tend to be firm-minded and can give criticism when appropriate	Often let decisions be influenced by their own and other people's likes and dislikes
Look at the principles involved in the situation	Tend to be sympathetic
Feel rewarded when job is done well	Dislike telling people unpleasant things
	Look at the underlying values in the situation
	Feel rewarded when people's needs are met

Allocating Time (J/P)

Judging	**Perceiving**
Like clarity and order	Enjoy searching and finding
Work best when they can plan their work and follow their plan	Procrastinate decisions while searching for options
May decide things too quickly	Can tolerate ambiguity
Concerned with resolving matters	Concerned to knowing, not resolving problems
Dislike ambiguity	Open-minded and curious
Can be inflexible once decision is made	Emphasis on diagnosing over concluding
Emphasize decision taking over information getting	Enjoy flexibility in their work
Like to get things settled and finished	Like things open for last-minute changes
May not notice new things that need to be done	Tend to procrastinate
Tend to be satisfied once they reach a decision on a thing, situation, or person	Tend to be curious and welcome a new light on a thing, situation,. or person
Reach closure by deciding quickly	Adapt well to changing situations and feel restricted without variety
Feel supported by structure/schedules	Focus on the process of a project
Focus on completion of a project	