INTRODUCTION

Every career requires certain skills for success, and careers in the machining field are no different. Since there is often a lack of understanding of machining careers, there is also often a lack of understanding of the skills and knowledge needed to be a successful professional in the industry. All machining careers require a combination of mental and hands-on skills, although the blend may differ in different positions. Many of these abilities can be labeled as personal skills, or soft skills, that are largely part of someone's personality or nature but that can be honed and improved over time with practice. Others are technical skills, or practical skills, that are largely learned through various methods of formal and informal training and practice. There is, however, some overlap between personal and technical skills.

Once someone has the skills that are needed for industry employment, the search for a job must begin. There are several steps to take along this path, and there are some key job-seeking activities to pursue.

This unit will discuss the personal and technical skills commonly needed for success in machining careers and provide some job-seeking suggestions that can help someone find the job that is a good fit.

Once again, the following resources can provide additional information about skills required for specific jobs as well as data on wages and the outlook for machining jobs.

- http://online.onetcenter.org/ is the home page of **O*NET**, the Occupational Information Network (O*NET) developed under the sponsorship of the U.S. Department of Labor/Employment and Training Administration (USDOL/ETA).
- http://www.careeronestop.org/ is the home page of **Career One Stop**, another website that is also sponsored by the U.S. Department of Labor.
- http://www.bls.gov/audience/jobseekers.htm is a page of the Bureau of Labor and Statistics, which is also a part of the U.S. Department of Labor.
- http://www.dol.gov/dol/location.htm lists links to individual state agencies that provide career and employment data and resources specific to each U.S. state and territory.

PERSONAL SKILLS

Personal skills are largely part of an individual's personality or natural ability, but they can be honed or improved with practice. Some are purely physical, some are purely psychological, and some are a combination of both. All play a key role in achieving success in machining careers.

Mechanical Aptitude

Mechanical aptitude is a combined mental and physical skill. It refers to the ability to visualize and understand basic laws of how things work and move. That includes the relationship between moving parts and the concept of cause and effect.

This skill is critical in the machining field, as there are many relationships occurring at the same time between machine tools, cutting tools, and the materials they cut. Those kinds of connections also exist in complex tool or machinery assembly. The talent to assess many factors and predict results is a daily occurrence for many machinists, mold makers, toolmakers, and die makers, and it is important for success in those machining jobs.

Manual Dexterity and Eye-Hand Coordination

Manual dexterity and eye-hand coordination describe the physical ability to precisely control hand motions. Performing intricate operations involving small movements to make fine adjustments is common in the machining field. This occurs during hand tool and machine tool operations as well as during assembly procedures.

Problem-Solving, Troubleshooting, and Decision-Making Skills

Problem solving, or troubleshooting, means being able to recognize when something is incorrect and then making corrections to fix errors. Because of the complexity of many processes in machining, it is not always easy to identify causes of problems. It is also an asset to be able to look at a situation and predict areas where problems might arise before they occur. This skill can be improved by training in machining principles, but the base capability of making judgments using many pieces of information is largely an instinctive skill.

Once problems are identified, decisions need to be made to correct them. To make good decisions, analyze as much information as is available. Then identify possible solutions. By projecting and comparing the outcomes of each possible solution, you can make decisions that provide the best expected result.

Focus and Concentration with Attention to Detail

To become successful in the machining industry, the machine tool professional must have a high level of concentration as well as an eye for detail. Because of the high-precision nature of machining, even small lapses in attention can lead to large errors and huge losses of time and money. The complexity of normal daily tasks

also calls for attention to minor details to ensure that specifications and goals are being met.

CAUTION

Because of the highly automated and powerful equipment used today, loss of concentration and attention can create unsafe situations leading to personal injury or even death.

Persistence and Patience

Machine tool professionals must have the mind-set to stay on task until projects are complete. They also must take the time and precautions to make sure that work is done correctly. There are many tasks, especially in intricate part machining, programming, and mold, die, and toolmaking, that take long periods of time to complete, and often little visible progress is seen on a daily basis. Instant gratification and completion is not usually the norm for those in the machining field, so it is necessary to possess or develop long-term vision and goals and be able to persist at work that can be time consuming and tedious.

Personal Responsibility and Reliability

People in positions such as set-up technician; programmer; machinist; die, mold, and toolmaker; and especially manager are frequently given responsibility for progress and project completion with very little supervision along the way. For this reason, these jobs require personal accountability to meet both short-term and long-term goals. These people must strictly meet specifications and ensure that final products are correct, so it is necessary for a person to take ownership of his or her own work.

Ability to Perform Multi-Step Processes

Due to the lengthy procedures and multiple steps needed to perform even common everyday operations, the machining industry worker must be capable of performing those steps accurately. Following written or verbal instructions is also crucial to complete daily duties.

Ability to Use Technical Reference Materials

Machine tool technical manuals and complex reference books are very common in the field, so the skill of finding information in these different forms is fundamental to accomplishing many machining objectives. Reference materials can be textbooks or technical manuals. The Internet is also a valuable resource for obtaining technical information through educational, manufacturer, and machining industry associations and forums. This skill can be partially learned by becoming familiar with terminology and the format of types of sources, but it also requires a solution- and detail-oriented mind-set to know what to search for.

Interpersonal Skills

In the machining field, there is often the need to work with others. Many times, you must work with people who are skilled in areas that you are not. There is a need to communicate effectively to share information. When working in a team setting, all members should value each other's input and cooperate to meet required goals and objectives. Respect for others and their opinions creates a positive environment that will promote continuous improvement and success.

Significant Memory Use

There is an incredibly large amount of information required to perform machining operations and become highly skilled and successful in the field. No one can remember every small piece of information, but there are many of these small, but very important, pieces of information that are used every day in the industry and are needed for even small tasks. There are certainly times when reference materials need to be used, but many, many mathematical formulas, machining principles, and concepts used on a daily basis need to become second nature in order for you to perform efficiently and effectively.

TECHNICAL SKILLS

Technical skills are those that can be learned and improved with practice. Many are the "hands-on" abilities that need to be combined with personal skills in order to build a successful career in machining.

Ability to Interpret Engineering Drawings

Engineering drawings or prints are the plans or maps to creating parts through machining operations. They are a two-dimensional representation of three-dimensional parts and contain many important facts about types of materials to be used, part dimensions, required degrees of precision, surface and finish requirements, and other engineering specifications.

A significant amount of time needs to be invested to become proficient in understanding the language of engineering drawings. This usually involves studying

sample prints and performing mathematical calculations using decimal and fractional numbers.

Knowledge of English and Metric Systems of Measurement

In today's global economy, there is a great deal of manufacturing that must meet specifications in both the United States and other countries around the world. For that reason, workers in the machine tool industry need to be able to recognize, compare, and convert measurements between the English, or inch, system and the metric system. Fortunately there are many tables and conversion charts available, but the skilled machining professional should be able to learn to use memory to reasonably visualize sizes in both inches and millimeters.

Proficient Math Skills

Whether planning or performing machining operations or conducting measurements, math plays a major role in the daily duties of machining professionals. Fractional and decimal operations as well as conversions between the two are needed every day. Basic skills in algebra, geometry, and right-angle trigonometry are also vital to performing common tasks.

Use of Hand Tools, Measuring Tools, and Machine and Cutting Tools

Different projects have different requirements according to specifications given on engineering drawings; so different tools will be used depending on those specifications. There are a very large number of different specialty hand, measurement, and cutting tools and machines in the industry, so those in machining careers must be able to select the proper tool for any given situation. Most of the tools used in the machining field are also very expensive, and many are very delicate, so proper use and care is necessary to avoid damage that leads to loss of time and money. Learning about the many tools in machining also requires a major investment of time.

Understanding of Metals and Other Materials and Their Properties

Machined parts can be manufactured from many different types of metals or other materials such as plastics, graphite, carbon fiber, or fiberglass. Metallurgy is the science of metals, and the basics must be learned to understand the characteristics of many different types of metals and how they will react during machining operations. That knowledge can also be applied in selecting the proper metal for a given application. The same can be said for nonmetal materials. There are many different compositions and grades of plastic, graphite, carbon fiber, fiberglass, and other materials.

Knowledge and Skill in the Use of Computer Technology

The computer is becoming a larger part of more and more occupations today. It is understandable that CNC programmers, designers, engineers, and managers need computer skills. But many other machining jobs require computer use also. Software is used in the field to perform tasks such as communication via email between coworkers, companies, departments and divisions of larger companies, and customers. Computer programs can be used to track orders, hours, and projects as they progress through different stages. The Internet can be a valuable resource to find and order tools and materials. For these reasons, today's machining professionals would be wise to learn basic computer skills.