

Aircraft Maintenance Competition

Technical Handbook



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Competition Sponsors

We would like to thank all our amazing sponsors that have assisted in making this competition possible:



Abstract

WorldSkills UK is an annual skills competition designed to promote standards and skills across the aero industry, developing competence into excellence.

The competition sees talented aircraft engineers test their expertise on a series of challenging practical tests in a bid to be named WorldSkills UK National Champion.

WorldSkills UK can bring invaluable benefits to students, colleges, and employers.

Competitors can gain recognition for exceptional skills, injecting dynamism, and excitement into training.

Employers can enhance their business reputation and improve the skills of their workforce.

The aim of this technical manual is to help competitors prepare for the Aircraft Maintenance competition from registration, through practice to qualifying and culmination at national level.

The guide contains general advice, technical tips and an in-depth overview of the competition structure and its content.



Haydn Jakes – WorldSkills International - Aircraft Maintenance

Gold Medal Winner – Kazan 2019

Royal Aeronautical Society overview

As the world's only professional body dedicated to the aerospace community, we exist to further the advancement of aeronautical art, science, and engineering around the world.

Established in 1866, the Society has been at the forefront of developments in aerospace, seeking to promote the highest professional standards and provide a central forum for sharing knowledge.

The Society now has over 22,500 members and has become an international, multidisciplinary professional institution dedicated to the global aerospace community.

The Royal Aeronautical Society is pleased to be able to be an organising partner of the WorldSkills Competition for Aircraft Maintenance and we look forward to inspiring the next generation of Aircraft engineers to achieve greater heights and supporting the competitors through the National stages of this highly renowned competition.

Your work, even if it's just one tiny component of a gigantic jet engine, touches the sky every single day.



Salim Semssar
GE Aviation Global Head of Quality



Role Overview

Aircraft Maintenance Fitters/Technicians work on maintaining aircraft of all types from small aeroplanes to airliners, jet fighters and helicopters, and more recently UAV's.

They are expected to carry out approved maintenance processes to maintain the airworthiness of the aircraft including inspection, servicing, modifying, troubleshooting, removal, installation, rigging, testing, and repairing.

Key attributes required by all aircraft maintenance technicians wherever they work are efficient work organisation, self-management, communication, interpersonal skills and problem-solving.

They must have the ability to work safely and rigorously adhere to civil or military regulations, manufacturer's instructions, and organisational requirements. These universal traits are the benchmark of an outstanding aircraft maintenance technician.

It's a responsible job as the aircraft maintenance technician is one of the last lines of defence to ensure the safety of the aircraft before flight, checking carefully and meticulously first time, every time.



Demonstrable Skills

Teamwork	Adaptability to change
Verbal communication	Initiative
Working with technology	Self-motivation
Problem solving	Attention to detail
Observation	Researching
Plan development	Time management

A genuine interest in, and passion for, engineering.

Job role and careers advice

To work on aircraft, you will need specific qualifications and certification, just as pilots are trained and then licensed to fly, aircraft maintenance engineers and fitters are trained and licensed to maintain the aircraft to an industry standard whether civilian or military based,

Travel

Aviation is a global industry and as such engineers and mechanics often have to work abroad to support airline operations at overseas airports. Financial models require aircraft to be operating at maximum profitability so an aircraft on the ground (AOG) situation requires rapid support. Military operations require working abroad, under possible hostile environments.



Hours

Aviation requires around the clock operations which is reflected in the need for a varied shift pattern workforce.

Environment

Tasks range from an indoor maintenance to flight line ramp operations sometimes at extreme temperatures and if military-rolled under harsh physical locations with minimal comforts.

Salary

Salary is based on multiple factors.

- Experience
- Level of licence held
- Number of aircraft types authorised to maintain
- Mobility

The starting salary for both civilian and military maintenance engineer averages £20k a year.

An experienced Aircraft Engineer with 10 plus years' experience having attained the expected specialist qualifications can expect an average total salary of £40k.

Career's advice

Most popular route is through an apprenticeship usually with a blended approach of on-the-job placement training alongside classroom based theoretical and system understandings.

This can be through a learning provider, further education institute, an aircraft operating concern with an in-house training facility or the military route.

www.careersinaerospace.com has a lot of useful guidance for young people who want to embark on a career in the aerospace industry, including apprentices

Other enquiries can be advanced through following links;

<https://www.gov.uk/become-apprentice>

<https://nationalcareers.service.gov.uk/>



Information and competition entry overview

WorldSkills UK information and Resources

WorldSkills UK has a wealth of information, guidance and resources on its website aimed at helping learners, educators, and employers.

[WorldSkills UK - Home Page](#)
[Skills Development Hub](#)
[Careers Advice Toolkit](#)
[Centre of Excellence](#)

WorldSkills UK Registration

For general information and resources on the WorldSkills UK 2022 competition cycle including how to register, competition rules and the steps to competing, visit the following link;
<https://www.worldskillsuk.org/skills/national-competitions/>

Further information relevant to pre-registration preparation can be found at;
[Pre-Competition Activity](#)
[Seven Steps to Taking Part](#)

For the Aircraft Maintenance landing page visit <https://www.worldskillsuk.org/competitions/>

Competition Entry Criteria

This is an individual competition

There is no age limit for Regional or National Competitions

The competition is intended for those studying, training and/or working in the aircraft maintenance industry. As such, competitors must be familiar with the core competencies listed in this handbook and either meet or at least be working towards one of the following criteria;

- Studying or enrolled on a level three programme
- Achieved a level three qualification in the last 12 months
- Gained a EASA Part 66 Qualification.
 - Up to level three for England, Northern Ireland, and Wales,
 - Up to level six for Scotland
 - Or up to five years' experience in a working environment).

There are no restrictions on what organisation may enter a competitor and they may enter learners/employees from learning institutes (colleges, universities, schools) or business of any size.

Competition Structure

Registration

Once you have completed your registration (and accepted all terms and conditions) you will receive email confirmation, and someone from the Royal Aeronautical Engineering Society will be in touch to arrange a time and date to email a link to complete the Passive test online

Prospective students should try to familiarise themselves with working under competition style activities, for example have a fellow student judge a completed work task during a timed practical session at college/training provider.

Passive Stage

The passive test consists of 73 multiple choice type questions. It is to be completed within 1 hour. It will be timed.

It covers a range of relevant topics and is aimed at challenging and assessing your knowledge of general and specific topics of aircraft maintenance.

When all registered entrants have completed the passive test, you will be notified if you have scored high enough to progress to the National Qualifying round.

National Qualifiers

Ensure you are ready to compete in your National Qualifier by reading and understanding the project brief, core competencies. This outlines the tasks you will be expected to carry out.

Ask your lecturer/employer for help in any areas where you feel you may have any knowledge gaps and work to improve/gain the necessary skills.

The National Qualifier will take place at Coleg Cambria College, Connah's Quay, Deeside, CH5 4BR. Competition dates to be released in due course, but an expectation will be May 2022.

Competition consists of three stances each one hour in duration. A competitor will be allocated a time and date and complete all tasks within a single AM or PM. Unsuitability of assigned time/date are to be discussed with the RAES.

WorldSkills UK Pre-National training

As part of the invitation to compete at the National Finals, WorldSkills UK Aircraft Maintenance invites all competitors to a training event beforehand. This is an excellent opportunity for all competitors to boost their confidence using/formularising the equipment in a safe environment, while replicating the competition project and expectations.

Training dates are yet to be released but expected in September/October 2022 over a two-day period at HMS Sultan, Gosport, Hampshire PO12 3BY.

WorldSkills UK National Final

The 8 highest scoring competitors across the National Qualifier will be invited to complete at the finals.

Competition consists of eight stances of varied duration totalling 18 hours over 2 ½ days.

Ensure you are ready to compete in your WorldSkills UK Live final by reading and understanding the project brief, core competencies. This outlines the type of tasks you will be expected to carry out.

Ask your lecturer/employer for help in any areas where you feel you may have any knowledge gaps and work to improve/gain the necessary skills.

WorldSkills UK International Competitions

Beyond the national finals, there are a host of opportunities for competitors.

Age-eligible competitors who show the highest skills, passion, and drive from the national finals will be given the opportunity to compete to train for the EuroSkills and WorldSkills international competitions.

Those who are not eligible for international competitions may join the Champions programme, which allows continued involvement, including the opportunity to work with WorldSkills UK and visit schools, colleges, and events to inspire the next generation.

Alternatively, if training is of interest to you, you could consider supporting WorldSkills UK with organising and training, and even helping to be part of the National finals.



Competition Specification

The competition has been designed to reflect the role of an Aircraft Mechanical Technician and the standards that are expected within the aeronautical industry.

At the Qualifying and National competition, competitors will undertake the following tasks:

- Aircraft knowledge
- Airworthiness check of an aircraft and/or individual component with possible associated defect rectification
- Design, build and test a hydraulic circuit
- Engine borescope
- Flying control rigging
- Sheet Metal repair
- Component removal, inspect and refit
- Composite repair
- Avionic / Electrical loom repair / diagnosis

Marking Allocation

The following is the marking criteria for the Qualifying competition:

Criteria	Task	Mark
A	Sheet Metal	33.33%
B	Component Inspection	33.33%
C	Flying Control Wear Check	33.33%
Total Marks		100%

The following is the marking criteria for the National Final:

Criteria	Task	Mark
A	Aircraft Airworthiness Check	12%
B	Hydraulic Circuit Design and Build	14%
C	Mechanical Rigging & Control	12%
D	Engine Borescope	8%
E	Sheet Metal	20%
F	PFCU removal	12%
G	Composite	14%
H	Avionic/Electrical Loom Build	8%
Total Marks		100%

Core Competencies

The following table lists the competitions core competencies and the expected standards within these from the WorldSkills UK national qualifiers through to the UK National Final.

Core Competencies and standards for WSUK UK Skills Competition activities		Qualifying	UK Final
Working Environment			
Competency	Knowledge and understanding of the working environment including: Comprehension and compliance with industry standards/laws relating to safety and hygiene Compliance with use of appropriate personal protective equipment for the working environment (PPE) Requirement for a workplan Industry standard manuals Precautions for safe use of tooling as required, including (but not limited too) - hand, power, cutting, electrical, wiring, pneumatic, calibrated and precision tools i.a.w normal and safe operations FOD and the implications within the aviation industry Cost and logistic resupply implications when using consumable materials	Y	Y
Standard	Competitors shall be able to: Comply with Health and Safety regulations & documentation Identify and use the appropriate personal protective equipment Work carefully within their work/competition environment Plan and organise work and resources, demonstrating effective time development Use a variety of tools (as required on both Mechanical and Avionic slanted taskings) in accordance with normal and safe operations Conduct pre-use and calibration torque checks on equipment as required Undertake continual awareness of FOD and the need to minimise Use consumable materials economically	Y	Y
Aircraft Airworthiness check			
Competency	Knowledge and understanding of: Working on aircraft Following process driven instructions Common fault parameters and recognition Interpret and act upon pilot divulged information to aid fault rectification	Y	Y
Standard	Competitors shall be able to: Safely navigate around, over and under the aircraft in accordance with judge's direction given at aircraft familiarisation Conduct an airworthiness inspection on a generic aircraft and/or specific components to determine serviceability status and if safe for further flight or additional inspections required Identify and correctly document fault symptoms on industry standard paperwork to reflect serviceability status	Y	Y

	<p>Interpret and troubleshoot pilot information to guide fault rectification</p> <p>Complete first line depth maintenance on defects found during inspections</p> <p>Accurately and efficiently troubleshoot the causes of unserviceability's, clearly record defects, and required rectification actions</p>		
Hydraulic circuit design and build			
Competency	<p>Knowledge and understanding of:</p> <p>System design requirements</p> <p>BS2917 and ISO symbology</p> <p>Fundamental hydraulic principles</p> <p>Function of the major system components</p> <p>Importance of contamination management</p> <p>Setting up procedures relating to hydraulic components</p> <p>Safe working practices associated with application of hydraulic power</p>	N	Y
Standard	<p>Competitors shall be able to:</p> <p>Interpret written system parameters into basic block build</p> <p>Select and install components as prescribed by the circuit diagram and system requirements</p> <p>Construct simple hydraulic circuits to demonstrate Flow, Pressure and Direction</p> <p>Test and functionally prove the performance of system involving the use of basic diagnostics</p> <p>Trouble shoot and overcome development issues post and during testing phases</p> <p>Work with live hydraulics and applying safe working practices</p>	N	Y
Mechanical rigging and control			
Competency	<p>Knowledge and understanding of:</p> <p>Working on aircraft</p> <p>Following process driven instructions</p> <p>Component removal</p> <p>Method of ensuring system operability is sufficiently restricted and the requirement for personnel safety whilst undertaking maintenance</p> <p>Cable damage criteria</p> <p>Cable tension principles</p> <p>Torque settings and measuring</p> <p>Types of locking devices required during normal maintenance</p> <p>Types of serviceability inspections methods and criteria</p>	N	Y
Standard	<p>Competitors shall be able to:</p> <p>Safely navigate around, over and under the aircraft in accordance with judge's direction given at aircraft familiarisation</p> <p>Understand and follow process driven instructions</p> <p>Ensure aircraft placed in safe scenario to allow personnel safe to interrupt and conduct system maintenance</p> <p>Component removal including item/system/aircraft safeguarding from environmental and personnel induced damage during system disassembly and reassembly</p> <p>Perform multiple locking methods including wire locking, split pins, tab washers</p> <p>Set flight control travel limits within range stops</p> <p>Complete torque checks, conversion between units of measurements, torque meter settings and interpretation</p>	N	Y

	<p>Complete visual and detailed cable examination to assess serviceability status</p> <p>Rig, tension and functionally test flight systems to manufacturers parameters and recognise indication of malfunction or incorrect rigging, abnormalities, or adjustment</p> <p>Accurately and efficiently troubleshoot the causes of unserviceability's, clearly record defects, and required rectification actions</p>		
Engine Boroscope			
Competency	<p>Knowledge and understanding of:</p> <p>Boroscope methodology</p> <p>Types of distress commonly found within the combustion chamber.</p> <p>Compressor, combustor chamber & turbine distress limits.</p> <p>Applying borescope inspection techniques to safely perform required inspections without damage to engine components</p> <p>Identifying and correctly assessing and reporting/recording defect indications</p>	N	Y
Standard	<p>Competitors shall be able to:</p> <p>Gain access to borescope portholes through equipment removal, as required</p> <p>Use handheld borescope equipment in accordance with manufactures instructions</p> <p>Manipulate borescope into areas to visualise distress without causing further damage</p> <p>Accurately measure features, position, magnitude, dimensions, and defect types</p> <p>Generate borescope reports</p>	N	Y
Composite			
Competency	<p>Knowledge and understanding of:</p> <p>Measuring, cutting and fabrication</p> <p>Repair processes</p> <p>Patch design</p> <p>Ply orientation</p> <p>Aerodynamic requirements</p> <p>Curing methods</p>	N	Y
Standard	<p>Competitors shall be able to:</p> <p>Transpose data, dimensions, and information from technical drawings to materials</p> <p>Trim material to required measurements and tolerances</p> <p>Demonstrate vacuum bagging</p> <p>Design and manufacture a suitable repair insert and overlay patches</p> <p>Complete a hand lay-up</p>	N	Y
Sheet metal			
Competency	<p>Knowledge and understanding of:</p> <p>Precautions for the safe use of mechanical and hand operated bending equipment</p> <p>Types of various technical drawings</p> <p>Measuring, cutting and fabrication</p> <p>Drilling techniques and sizing</p> <p>Finishing techniques with files, sanding, and deburring</p> <p>Aeronautical sheet metal industry standards and practices</p> <p>Assembly technique for multiple sheet metal plate using multitude array of fasteners</p>	Y	Y

Standard	<p>Competitors shall be able to:</p> <p>Interpret drawings and extract information as required</p> <p>Transpose dimensions from technical drawings to material</p> <p>Trim materials to required measurements and tolerances</p> <p>Removal of metal with varying levels of access</p> <p>Drill and countersink holes to different sizes</p> <p>Apply appropriate finishing techniques to faces, edges and holes</p> <p>Perform in accordance with AC43-13</p> <p>Install variety of rivets, solid and blind (countersink and snap) to assemble the repair</p>	Y	Y
Component removal			
Competency	<p>Knowledge and understanding of:</p> <p>Follow process driven instructions</p> <p>Component removal techniques</p> <p>Torque settings and measuring</p> <p>Types of locking devices required</p> <p>Types of serviceability inspection methods and criteria</p>	Y	Y
Standard	<p>Competitors shall be able to:</p> <p>Understand and follow process driven instructions</p> <p>Component removal including item/system/aircraft safeguarding from environmental and personnel induced damage during system disassembly and reassembly Safeguarding items removed to ensure rebuild completed correctly</p> <p>Complete torque checks, conversion between units of measurement, torque-meter setting and interpretation</p> <p>Perform multiple locking methods including wire-locking, split pins, tab washers</p> <p>Complete visual and detailed examinations to assess serviceability status</p>	Y	Y
Avionic/Electrical Loom Build			
Competency	<p>Knowledge and understanding of:</p> <p>Follow process driven instructions</p> <p>recognition of electrical components</p> <p>Standard wiring practices manual</p>	N	Y
Standard	<p>Competitors shall be able to:</p> <p>Correctly carry out process driven SST.</p> <p>Multimeter (Fluke 112) Pre-use checks and operation</p> <p>Follow a standard wiring diagram</p>	N	Y
Competency	<p>Knowledge and understanding of:</p> <p>Manufacturing of aircraft electrical looms and terminations</p> <p>Correct tooling</p> <p>Follow process driven instructions</p>	N	Y
Standard	<p>Competitors shall be able to:</p> <p>Correct selection of components from stock</p> <p>Sound understanding of the theory and operation of the circuit</p> <p>Correctly carry out an SST to ensure serviceability of the aircraft system</p>	N	Y

General Competitor Instructions

It is the competitor's responsibility to arrive at the event each day, late arrivals risk exclusion or reduced timings.

If travelling long distances to the competition discuss with RAES

A hands-off, walk around will take place prior to competition commencement of any stances to allow familiarisation with equipment due to be used. Judges will be onsite to answer generic questions accordingly. No practicing of the task will be entertained.

Unless directed otherwise the timing for the task will commence immediately after the judges Health & Safety brief. Any additional time for familiarisation will be indicated prior to the task bespoke brief starting.

Ensure that you have read and fully understood the task objective, including the time allocated for the task and all supporting resource material provided within the Competitor Task Sheet. When you are content with what is required you should alert the judge and then initiate your work.

All materials and equipment must be accurately checked by the competitor upon commencing the competition and marked out/used in the most economical method. Marks will be deducted for inaccuracies beyond tolerances as indicated on the drawing and the marking schedule.

Specifications, drawings, technical guidance, consumables, and all tooling will be provided prior to commencement.

On completion all tools/equipment to be returned to their correct stowage, area cleaned and presented to the examiner. Marks will be lost for misplaced, lost, or spoiled materials and equipment if as a direct resultant of competitor action.

Should you sustain an injury which requires first aid treatment then you are to bring it immediately to the attention of the task judge who will determine the course of action required. Whilst a course of action and subsequent consequential actions are complied with, the event clock will be stopped. The clock will be restarted upon subsequent event recommencement.

Competitors may leave the area for comfort and non-essential breaks, but the tasking clock will not be stopped.

Judges may be required to carry out stage checks as deemed necessary. When required the clock will be stopped and not restarted until completion of the stage check and the competitor is able to resume the competition.

Competitors are actively encouraged to wear branded corporate clothing promoting their college/employer.

Judges Top Tips

The following tips are neither exhaustive nor prescriptive and not a 'magic' formula to success. However, these are tips based on being involved with competitions for many years and they should assist you in future competition participation.

- **Preparation and Practice**

A successful competitor needs to be calm, confident, and self-assured when competing. Prepare by practising your skills and techniques to ensure you achieve the required standards/results

- **Pressure**

Undoubtedly you will be nervous and stressed.

However manageable stress gives increased energy and raised performance potential. The key is managing the level and not allowing induced pressure to overwhelm you.

- **Understanding the task**

Listen to/read the Judge's brief and ask questions if unsure.

Note that depending on the nature of the question asked the judge may decide that guidance is not appropriate in the interest of the competition.

Read the competitors' brief at least twice - all task information is in the brief.

Take a deep breath and start the task. You are against the clock, so work with focus.

- **Standards**

Remember tolerances are the limitations on full marks being awarded. Once achieved move on.

Think cleanliness, ensure the work is clean enough to ensure the judge can mark.

If a Stage Check is mandated ensure it is completed – marks will be lost for non-compliance.

- **Time Management**

Learn to manage your time effectively when completing tasks by working smart not fast.

Practice working to time constraints under pressure to perfect your timings.

Section the task into stages and allocate timing blocks accordingly.

When sections are completed revisit the time allocation and readjust as required.

- **Task Completion**

Remember, it is a competition and everything you do within the task is marked and therefore either worth points or subject to negative marking in the event of unsatisfactory completion.

Finish the task – you can't obtain marks if you don't complete the task.

- **Holistic view**

Keep yourself fit.

Have a positive and confident mental attitude
Drink water not energy drinks – they give a short performance energy burst but concentrations will drop dramatically.
Eat well – bananas are a good source of slow, lasting energy release.
Get decent sleep hours.
Be wary of alcohol.

- **All going wrong**

Take a moment, step back and think.
If necessary, re-read the brief.
Refocus, deep breath and go again.

After completion if the task hasn't gone as well as planned, do not dwell, move on, and start the next time afresh. The competition is designed to test you so don't feel bad.



- **Final Considerations**

Everything you do is marked so always think excellence.
Aircraft technicians always think FOD so ensure you maintain a tidy work area.
Ensure time is allocated to ensuring the area is cleaned upon task completion.
Tools and equipment's should be returned to the correct stowage's.
Using calibrated hand tools - think calibration checks.
Using POL - think COSHH, Risk Assessments, Safety data sheets
Think Safe - think PPE

And above all - enjoy the experience, no matter how far you make within the competition. Remember you've earned your place here, whether it be by employer/college recommendation or excellence at a qualifying competition.

Complaints

A copy of the WorldSkills UK Complaints Procedure will be communicated to all competitors prior to commencement.

A copy will be available throughout the competition.

Health and Safety

Competitors must provide their own safety footwear.

Generic and bespoke Health & Safety brief will be conducted immediately prior to the task commencing.

It is the individual's responsibility to take reasonable care of themselves and others whilst at work. This includes the correct wearing of appropriate clothing and footwear for the activity being undertaken.

Any specialised Personal Protective Equipment required for an activity will be made available by the competition host.

Judges are to provide direction on any actions that are in contravention of the Health & Safety regulations and where appropriate they may deduct marks for such non-compliances.

Continual disregard for Health & Safety by a competitor will result in the task being terminated prematurely. A competitor will be warned if his continuation of Health and Safety disregard is considered of a severity worthy of expulsion. Lead judge decision will be final.



The best thing about my skill is the satisfaction I get from keeping aircraft safe.

Skills have changed my life because of opportunities and experiences that I have had so early in my career. You should consider a skill as it is a very rewarding career path with many opportunities that you could never imagine existing!

**Jarrod Wood,
WorldSkills International - Aircraft Maintenance
Abu Dhabi 2017**



WorldSkills UK 2021 National Final - HMS Sultan

Further sources of information and websites

WorldSkills UK

Email: enquiries@worldskillsuk.org Web: www.worldskillsuk.org Tel: 0800 612 0742