Writing a Winning Proposal for the Airport Cooperative Research Program (ACRP) University Design Competition for Addressing Airport Needs

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Principal Investigator/Researcher – Federal Aviation Administration (2011-2019):
Geothermal Airport Pavement Snow-Melt and Terminal Cooling System

Researcher – Federal Aviation Administration (2019-2021):
National Vegetative Growth Management Database and Analysis for Airports

My ACRP Competition Experience

- Multiple 1st, 2nd, 3rd, and Honorable Mention finishes by Binghamton University students in the ACRP Competition since 2009

- Multiple national presentations of their proposals by Binghamton University students: including Philadelphia, Minneapolis, Chicago, Boulder, Oshkosh, Denver, Arlington

- $2,100,000 FAA and NYSERDA grant to build a student project proposed in the ACRP Competition

- $200,000 FAA grant to create a database for *National Vegetative Growth Management Database and Analysis for Airports,* as proposed in the ACRP Competition

- Several years experience serving on the review panel that evaluates student entries to the ACRP Competition (not in the challenges entered by Binghamton University students)

- Instructor of "Professional Communication and Ethics" in the College of Engineering at Binghamton University - SUNY

In Brief - Why the ACRP competition?

This competition offers a unique opportunity for a team of students to analyze, understand, design, and document a systematic approach to solving a specific airport problem, not only through communicating with each other, but also with airport operators and aviation industry professionals.

Regardless of your college major or future job description, employers expect that you have the skills to communicate effectively (both written and oral) with professionals representing a range of experience and responsibilities. This competition will hone your communication skills to a new level of expertise.

Reviewer's Hints: The cash awards to students are certainly an additional benefit.

Getting Started:

The best place to begin is to review the following:

Competition Website:
http://www.trb.org/ACRP/ACRPDesignCompetition.aspx

The Guidelines:
https://vsgc.odu.edu/acrpdesigncompetition/wp-content/uploads/sites/3/2021/08/2021-2022-ACRPDesignGuidelines-8-12.pdf

The Evaluation Criteria:
https://vsgc.odu.edu/acrpdesigncompetition/evaluation-2/

Frequently Asked Questions:
https://vsgc.odu.edu/acrpdesigncompetition/faqs/

Resources:
https://vsgc.odu.edu/acrpdesigncompetition/resources/

More on Getting Started:

On the competition website is a link with <u>Tips for Proposers</u>. Be sure to take a look.

Take time to review prior entries placing first, second, third, and honorable mention at:
http://www.trb.org/ACRP/ACRPDesignCompetition.aspx and click on *Competition Winners*

Reviewer's Hint: The first place entries won for a reason. You will see similarities among all of them. Aim for that same level as your goal for writing your proposal.

In summary, your task is to:
- Identify a problem
- Propose an improvement or something new
- Provide proof of concept (within the limits you have)
- ***WRITE WELL!***

Please be aware that in this presentation, for brevity, I am not covering some of the more straightforward requirements. Be sure to include all requirements in your writeup.

Choose a Challenge Area

This Competition focuses on design solutions in the following broad areas:

Airport Operation and Maintenance
Runway Safety/Runway Incursions/ Runway Excursions
Airport Environmental Interactions
Airport Management and Planning

Reviewer's Hint: Some specific challenge areas are defined in the Technical Design Challenges section of the Guidelines. Students are not limited to the suggested topical areas listed. You are free to propose design solutions based on other topics that fit the four broad challenge areas. For ideas, you may want to take a look at Technical Design Challenge Links

Need ideas?

Check out previous and ongoing Airport Cooperative Research Program (ACRP) Studies and Reports: As you explore ideas for design proposal topics, you will want to start by reviewing recent ACRP studies to get a sense of what topics have attracted the interest of the airport community. Go to https://www.nap.edu/author/ACRP/transportation-research-board/airport-cooperative-research-program to see links to recent studies.

Another source of ideas might be the FAA Portfolio of Goals https://www.faa.gov/about/plans_reports/media/portfolio_goals.pdf

Reviewer's Hints: Don't spend a lot of time choosing a topic! Time is shorter than you think it is! Be sure your proposal is innovative and offers fresh thinking or new ways of approaching a problem and reflects creativity and imagination. Don't make the reviewer's guess if your proposal has met these criteria. Point out, specifically, how your proposal accomplishes these goals. Fourteen points are awarded just for choosing an innovative topic so be sure to explain, where appropriate, that your proposal is innovative, creative, and a fresh way of thinking about the problem at hand.

Prepare the *Table of Contents* and a Schedule for Completion

From the information in the Guidelines at:
https://vsgc.odu.edu/acrpdesigncompetition/wp-content/uploads/sites/3/2021/08/2021-2022-ACRPDesignGuidelines-8-12.pdf create a Table of Contents.

Reviewer's Hint: Create a preliminary table of contents at the very start of your project. Then, using the table, immediately create a tentative schedule for all items. Put a due date next to every entry in the table. Many sections of the requirements can be completed very early in the cycle, so get those done right away! Review the schedule every week. As a reviewer, I can tell when students run out of time and rush towards the end. Don't let that happen! Two points are awarded just for creating the table.

Reviewer's Hints:

TEAMWORK

Scheduling:
If you are working as a team, split up the project assignments right away. Use your Table of Contents to be sure all tasks are assigned. Many pieces of the project can be completed early and/or simultaneously.

One Author: the proposal needs to be one cohesive document that is written as though there is just one author. In other words, all writing styles must match. A solution to this is to have an editor responsible to be sure that each section has the same writing style and uses the same format for text, references, diagrams, etc.

Individual Performance: We all know that teamwork can be wonderful because of the synergy of the group, but sometimes a teammate does not work as expected. To help avoid any repercussions in this regard, always have teammates show their work every week. If someone is not living up to expectations be prepared to discuss this with your faculty advisor. Do not allow your work to get delayed. In the end, this is all very obvious to the reviewers.

Preparing the *Literature Review*

To fully understand what work has already been completed in the area of your proposal, and to get a better understanding of the problem at hand, a literature review must be conducted.

A literature review lists and summarizes the key resources that you have reviewed on your design topic and critically evaluates and analyzes those resources. A literature review is far more than a bibliography. It provides a summary of those resources, provides an understanding of the state-of-the art in the subject area, and identifies existing knowledge gaps or processes where your innovative approach can contribute. Your literature review is the foundation for justifying your design and approach and for describing how it will meet an existing need or fill in a gap.

Reviewer's Hints: Be sure to cite every document you researched even if it did not lead you to your solution. Every source you look at helps lead you to a solution, so be sure to include all reviewed documents in this section.

Specific reference citations are to be provided in Appendix F. Be sure to review the [Style Sheet for References/Citations](#). Note that your Literature Review, as well as all other sections of your proposal, must specifically reference every resource you reviewed and have an accompanying citation in the References section of your proposal.

continued:

Literature Review continued – Where to Look for Sources

The **Airport Cooperative Research Program** (**ACRP) website** offers a wealth of research papers and other documents that students should consider while preparing their proposal. Links to previous and current ACRP research articles are available on the ACRP web site: www.nap.edu/author/ACRP/transportation-research-board/airport-cooperative-research-program.

Learn how to search ACRP Publications for Key Terms before you begin your Literature Review: https://vsgc.odu.edu/acrpdesigncompetition/wp-content/uploads/sites/3/2018/12/SearchingACRPForKeyTerms.pdf

The Transportation Research Board website:
https://www.nationalacademies.org/trb/transportation-research-board contains the latest studies on topics of interest to the ACRP.

Reviewer's Hints - The review panel will carefully consider the thoroughness and appropriateness of this section with respect to your chosen design topic. Be sure your Literature Review consists of the sources described above as well as many other sources.   Eleven points and ***must include ACRP references.***

Preparing the *Problem Statement and Background* Section:

This section should demonstrate that you have a clear understanding of:

1. The issues surrounding the design challenge
2. Current conditions as appropriate to your proposal
3. State-of the-art approaches currently in use (that do not seem to be working as well as your solution)

- Clearly define the Design Challenge and the exact problem you are proposing to solve.
- Clearly define what has been done in the past.
- Clearly define what is currently being done (if appropriate to your project) that needs to be improved upon
- Clearly state how your project will move the industry forward
- State the FAA goals that are relative to your project and reference the FAA Portfolio of Goals: http://www.faa.gov/about/plans_reports/media/FY10%20Portfolio%20of%20Goals.pdf
- Also review and reference <u>the </u>FAA Flight Plan (Strategic Plan): http://www.faa.gov/about/plans_reports/media/flight_plan_2009-2013.pdf

Reviewer's Hints:
The intent here is for you to prove to the reviewers that you have a clear understanding of the problem you are trying to solve and what has been attempted in the past to resolve this problem. Ten points.

Getting Started on the *Problem-Solving Approach*

There are two major components to the *Problem-Solving Approach*. One of the components is to describe the various ideas, procedures, and processes you undertook while creating your proposal. Begin documenting and describing every step you take from start to finish, in detail from assigning work across a team, creating a schedule, classroom design discussions, visits to an airport, discussions with airport and industry professionals, alternatives discussed, how your topic was chosen, classroom visits by professionals, alternatives that were investigated, and how you arrived at those alternatives.

Reviewer's Hints:
Be sure to begin documenting your approach right now. You will not remember every step later on, so begin documenting everything right from the start. Document each step and everyone you communicate with. This will be an important component that the competition reviewers will be looking at closely. Photos of each important step are very convincing to reviewers.

Remember to update your bibliography as you work through your proposal. It is too difficult to try to later remember where a source of information was found. Document/cite every source of information you use. Be sure to cite all diagrams and photographs that you did not produce yourself and get written permission to use any outside material you include in your written report.

Preparing the *Problem-Solving Approach (Part II)*

Once you have completed the Problem Statement and Background, it is time to begin preparing the second part of the Problem-Solving Approach. The purpose here is to provide your solution and provide the engineering/scientific principles that you used to arrive at your proposed solution.

1. **Methodologies:** Be sure to use and document a solid engineering/scientific design process and formal methodologies to arrive at your solution.
2. **Solution**: Describe the proposed solution and how you arrived with that as your solution as opposed to the other alternatives reviewed. Include a table of alternatives with stated advantages and disadvantages.
3. **Diagrams**: Support your design using appropriate drawings, mockups, computer codes, charts, tables or other data. Be sure to provide a citation for everything you did not create.
4. **Maintenance**: Discuss Maintenance Considerations (what has to be done after the proposed system is installed to keep it running).
5. **Regulations**: Investigate, and show evidence of understanding, any Regulatory and Certification Issues appropriate to your proposal.

Continued:

Preparing the *Problem-Solving Approach (Part II) Continued*

6. **Lessons Learned**: Discuss lessons learned along the way to investigating your topic and writing your proposal.

7. **Conclusions**: Discuss and support your conclusions with testing, testimonials from experts, or other means as appropriate

8. **Proof of Concept**: Demonstrate/prove (on a very small scale) that your system will work as described.

9. **References:** Document within the text of your proposal a reference of every resource you use when writing your proposal and have an accompanying citation in the References section of your writeup that corresponds to each reference.

Reviewer's Hints: Thirty-four points, the most of any category, so work hard on this section.   Everything here is very important.

Citations, References and the Bibliography

- **Cite all sources.**
  - All sources used in your Literature Review are to be cited
  - Cite all information used to write the entire proposal.
  - Cite all diagrams you did not produce yourself
  - Cite all data sources
  - Cite all photographs you did not produce yourself

- Use whatever style you are most familiar with. See the [Style Sheet for References/Citations](#)

Reviewer's Hints:

- Citations consist of two critical components. The part within the text of the paper indicating the information was elsewhere, and then the actual citation in the References section of the paper.

- Begin your bibliography right at the start of working on your proposal. You will most likely not remember where a source of information was found, unless you document it immediately. Document/cite every source of information you use along the way to completion of your proposal

- A website URL without a full citation is never considered an adequate reference.

- Websites such as *Wikipedia* and *How Things Work,* are nice sources of information to lead you elsewhere but are never to be used as references, as the information provided is not reviewed to the higher level of professional publications.

- Personal websites are typically not considered as appropriate references for professional work.

- Review past first place winners for examples of properly citing and referencing the works of others http://www.trb.org/ACRP/ACRPDesignCompetition.aspx and select *Competition Winners* from the menu.

Preparing the *Interaction with Airport Operators and Industry Experts* Section

A required component of the competition entry is for you and your team to interact with **both** airport operators and industry experts during the design process.

Document your interactions in your Problem-Solving Approach section or in a section dedicated to the topic of Interaction with Airport Operators and Industry Experts Section as appropriate. However, note that there is a requirement to list all expert resources in Appendix C.

Reviewer's Hints:
Typically, an airport operator is someone who manages an airport or certain aspects of an airport. For the sake of this competition, pilots are considered as "Industry Experts" and are not considered "Airport Operators".

Continued:

Preparing the *Interaction with Airport Operators and Industry Experts* Section continued

Reviewer's Hints:

Go to an airport! Calls and emails to an airport can be very useful, but nothing is better than being there is person. Reviewers prefer to see that you got out of the classroom and visited an airport to view the problem first-hand and to meet with airport operators and industry experts. It is important to document every interaction even if the interaction does not prove useful to your solution.

Invite Industry Professionals to your class or offer to meet them where they work.

Not sure how to connect: Just call an airport and ask to speak to the airport manager. Or try contacting several [Expert Advisors](#)

Consult professionals for ideas to begin your proposal and then throughout your project. Document EVERY interaction with a professional. Then, have professionals review your final entry while there is still time to make corrections.

Sixteen points so be sure to fully explain your interactions. Also, be sure to identify if the experts are airport operators or industry professionals, as there is scoring for each category.

Preparing the *Safety Risk Assessment*

Conduct a safety risk assessment of the proposed design. Consider inherent risks and describe how these risks will be (should be) addressed to ensure safe operations.

Be sure to use, reference, and show an understanding of the following FAA documents:

Introduction to Safety Management Systems for Airport Operations (FAA Advisory Circular 150/5200-37)

FAA Safety Management System Manual

ACRP Report 131 – A Guidebook for Safety Risk Management for Airports

ACRP Report 50 – Improved Models for Risk Assessment of Runway Safety Areas

Reviewer's Hints: Reviewers will be looking to be sure you fully understand the risks associated with your proposal and that you have used the above documents (use them AND reference them). Be sure to view the video, Completing a Safety Risk Assessment by Wes Timmons. If you follow the process explained in the video and provide the necessary documentation, including a detailed risk matrix, you will be sure to get full points for your efforts from the reviewers. Eight points.

Preparing the *Projected Impacts* Section

FAA Goals: provide a thorough discussion and clearly state how the design/solution meets FAA goals. Specifically state (and reference) the FAA goals related to your project.
https://www.faa.gov/about/plans_reports/media/portfolio_goals.pdf

National Needs: Provide proof that the proposed design meets identified national needs for the area being addressed.

Commercial Potential: Address the commercial potential (is there a market and is your proposal affordable) and the potential real-world impact (for example, safety, or energy savings, etc.) of the proposed solution.

Describe the Processes for Implementation including a description of processes that would need to be undertaken to bring the design to the product/implementation (commercial) state

Affordability and Utility - Financial Analysis - Provide a financial analysis including a cost/benefit comparison:
      a. Include all upfront costs as well as maintenance over a 5 to 10 year period
           (and possible replacement at the end of its life).
      b. Summarize how the proposed design offers costs savings and/or other benefits.
      c. Provide a discussion of how your project could be marketed. Provide a description of the processes
           that would need to be undertaken to bring the design to the product/implementation state.

Continued:

Projected Impacts Continued

Reviewer's Hints:

Review the video, [Guidance for Preparing Benefit/Cost Analyses](#) by Dave Byers. Then create a formal Cost/Benefit Analysis using EXCEL including all data in table form. If you provide a cost benefit using the same style, tables, etc. as those shown in the video, you will surely receive full credit by the reviewers for this section of your proposal.

Try to determine sources of funding. The FAA finances most airport upgrades. You can learn about specific funding sources within the FAA by performing a search.

Don't make the reviewers guess if you have covered all the required topics. Use explicit terms such as, "FAA Goals have been met by…", "National Needs have been met by …." and "The Process for Implementation is as follows…"

Twenty points, the second highest points category, so be sure to spend time on this requirement. Each component in this category is of equal importance.

Preparing the *Executive Summary*

The Executive Summary must include the following and should not exceed one page in length:

- State the problem being solved

- Briefly discuss the background information on the topic

- Briefly explain the process undertaken to arrive at the conclusion

- Provide a brief description of the solution and/or conclusions

Reviewer's Hints:

Even though the Executive Summary appears at the beginning of your proposal, it should be written towards the end of your project. The Executive Summary summarizes your competition entry in a manner that readers can rapidly become acquainted with the intent of your proposal, including a brief discussion of the solution to the identified problem. Two points.

Reviewer's Hints: Quality counts!

Be sure your proposal:
- Is well-written including grammar, spelling, and style!
- Is well-organized
- Is complete and includes all required sections and every section is complete
- Clearly explains
  - the problem,
  - the solution,
  - how you arrived at the solution.
- Appears to have one author (piecing together work done by teammates is not the way to go)

Be sure you have referenced ALL information gathered from outside sources. Include those references in the correct format in the body of the paper and then include the full citation in the References section of the paper.

Be sure to go back and review all requirements

PROOFREAD! Have more than one proofreader.

Sixteen points so pay attention to details and be sure to include everything asked for.

Reviewer's Hints: Photographs, Drawings, Mockups

Drawings and Mockups: Wherever possible, show drawings or mockups to support your work. Hand drawing is acceptable, but not freehand. In other words, your work should not appear to have been done on an old napkin. Provide professional looking work throughout your document.

Photos: Photos can be a huge advantage to prove how engaged you were in creating your proposal. Reviewer's will react positively to photos to document a visit to an airport. While visiting take photos that are relative to the problem you are trying to solve. Providing photos to help visualize the problem with the way things are currently done are very valuable to the understanding of your topic.

If you visit professionals or they visit you, take some photos. Visualizing your engagement with those in the profession will have a positive influence on reviewers.

References: Be sure to provide a citation for every drawing, photo, or other visual that you did not create.

Photos and/or Drawings and Mockups of the following would be favorable to the reviewers.
- Visuals of complete design
- Visuals proving the concept will work as described
- Screen mockups, etc.
- Your visit to an airport

Reviewer's Hints: Evaluation and Final Review

Using the official Evaluation Criteria for the competition found at
https://vsgc.odu.edu/acrpdesigncompetition/evaluation-2/, perform an independent review of your work based <u>only on what is presented.</u>

Remember that the reviewers will only see your written work, not the effort behind it. Therefore, be very sure you work is presented favorably and that the amount of effort expended is reflected in what you have written.

Once you perform a thorough review, go back and make the necessary adjustments to your proposal and then review again.

If possible, an outside professional with no familiarity of your effort would be an ideal reviewer. If you have to explain anything in your proposal to a reviewer, then your proposal can be improved. Remember that the reviewers will not have the chance to ask you for clarification on anything within your proposal.

Reviewer's Hints: Grammar, Spelling, and Style

Be sure to follow the exact formatting, writing, and style requirements as provided in the Guidelines at
https://vsgc.odu.edu/acrpdesigncompetition/wp-content/uploads/sites/3/2021/08/2021-2022-ACRPDesignGuidelines-8-12.pdf

- **Spell Check - Style Check - Grammar check**
- **Acronyms and Abbreviations** – all must be defined on first use. For example; Federal Aviation Administration (FAA)
- **Numeric Information** –
  - Numbers 1-10: Use English (i.e. nine)
  - Numbers > 10: Use digits (i.e. 57)
  - Large numbers: digits followed by English (i.e. 100 million)
  - Never begin a sentence with a digit
  - **Data: ALWAYS USE DIGITS**
- **Time-** 11:20 a.m.; 10:36 p.m. plus time zone where applicable
- **Examples and Analogies** – use frequently
- **Statistics and Facts** – must be referenced
- **Quantify** – Provide numeric descriptions of anything quantifiable (*7 million units sold*) rather than descriptive definitions (*phenomenal sales*)
- **Opinions** – referenced; from experts only. Remember you are not an expert (yet)
- **Money -** $105 (*not* 105 dollars)

Reviewer's Hints: Spelling, Style, and Grammar Checkers

In all your work, especially for entry in a national competition, always check your work for spelling, style, and grammar.

Because MS Word is the most widely used editor, instructions for settings and running the checkers follow:

Continued:

Reviewer's Hints:

MS WORD
From the *File* menu
  choose *Options*
  and then choose *Proofing*

Check the boxes in the
menu diagram shown here.
Do not check the boxes
without checkmarks.

Next to *Writing Style* be
sure to choose
Grammar & Refinements

Then choose *Settings*

Continued:

Word Options   ?   ✕

General

Display
                    Change how Word corrects and formats text as you type: AutoCorrect Options...

Proofing
                    When correcting spelling in Microsoft Office programs

Save
                    ☐ Ignore words in UPPERCASE
Language   ☑ Ignore words that contain numbers
                    ☑ Ignore Internet and file addresses
Ease of Access   ☑ Flag repeated words
                    ☐ Enforce accented uppercase in French
Advanced   ☐ Suggest from main dictionary only

Customize Ribbon   Custom Dictionaries...

Quick Access Toolbar   French modes: Traditional and new spellings ▼

Add-ins   Spanish modes: Tuteo verb forms only   ▼

Trust Center
                    When correcting spelling and grammar in Word

                    ☑ Check spelling as you type
                    ☑ Mark grammar errors as you type
                    ☑ Frequently confused words
                    ☑ Check grammar with spelling
                    ☑ Show readability statistics

                    Writing Style: Grammar & Refinements ▼   Settings...

                       Recheck Document

                    Exceptions for: 📄 Document1   ▼

                    ☐ Hide spelling errors in this document only
                    ☐ Hide grammar errors in this document only

                                                    OK   Cancel

Reviewer's Hints:

MS WORD continued:

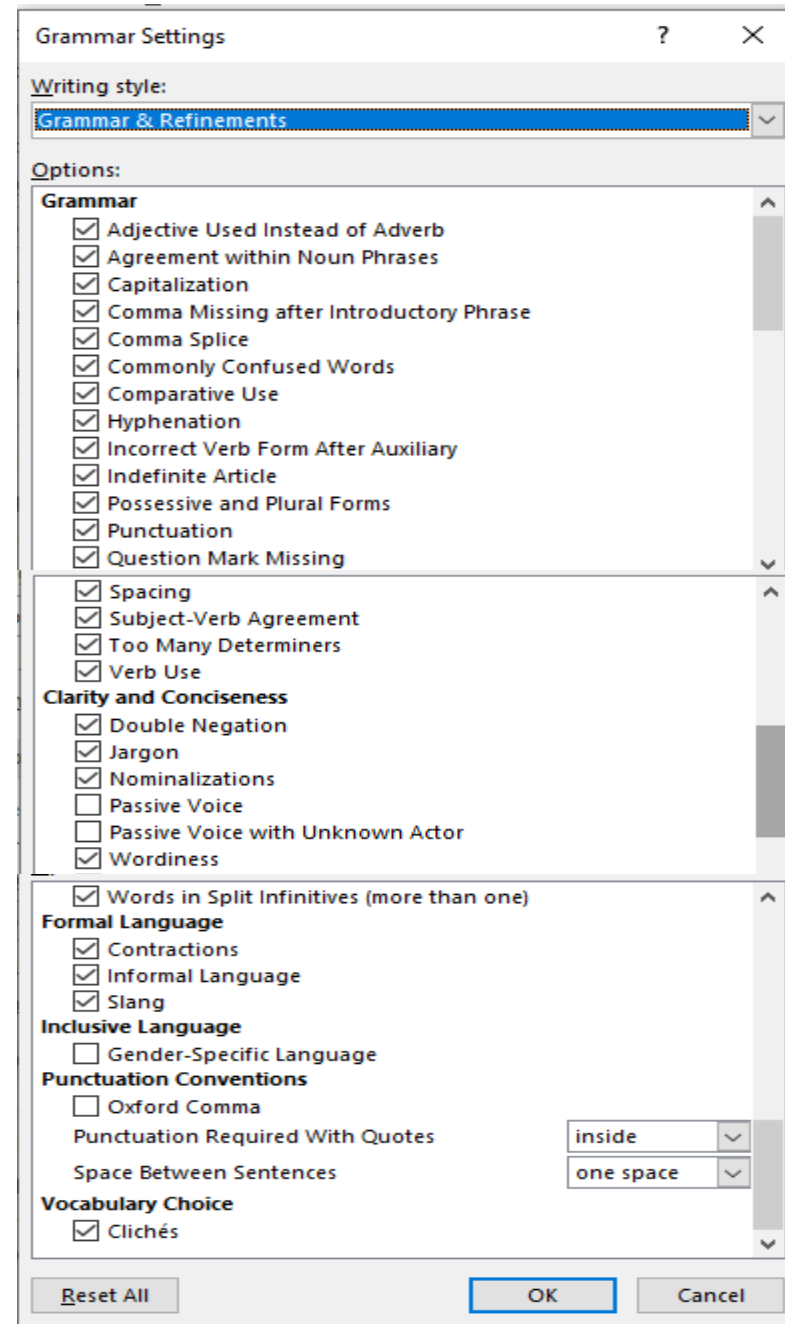On the *Settings* menu, check every item shown in the diagram to the right.

Note that four boxes are not checked.

You may check all the boxes if you wish, but these show my typical settings.

Secure your settings by choosing *OK*.

This will return you to the Proofing Menu where you will want to choose *OK* again and all menus will then close.

Continued:

Reviewer's Hints:

WORD continued:

From the Word main menu select *Review - Spelling and Grammar -* and the review will proceed.

NOTE that the Spelling and Grammar Checker will not recheck changes in your document (even if you select *Review* a second time). You must therefore, reset the Checker.

To reset the Checker:
　　From the Word main menu select *File – Options - Proofing*
　　From the *Proofing* menu select *Recheck Document* and *OK*

To restart the Checker:
　　From the Word main menu select *Review - Spelling and Grammar -* and the review will start over.

Reviewer's Hints: Professional Ethics:

Purchasing Papers:
If a paper is purchased for the purpose of passing it off as work performed and/or written by the purchaser, then certainly, this act of would be considered unethical.

Plagiarism:
Plagiarism is defined as not giving due credit for the use of someone else's work. Plagiarism is the use of *any* work, that is not your own, that was not given due credit, and includes published or unpublished works, Internet information, product information, work done in courses, work done by other students, purchased papers, etc.

Copying:
Copying is defined as work that has been copied from/by another person, *even with permission*, and then misrepresenting that work as your own.

Continued:

Reviewer's Hints: Professional Ethics Continued:

Falsifying Data or Results:
Unfortunately, reports of falsified information have at times surfaced in a quest to utilize data that produced unreliable results, or to ensure that the results of a study produced a predetermined outcome. Certainly, this behavior is deemed unethical.

Intellectual Property - <u>Patents:</u> The purpose of intellectual property is to reward and encourage producing things that society values. In the case of patents, the idea is to encourage invention and accelerate the pace of technology. In return for disclosing their work, inventors receive an exclusive right to that invention for a limited time. https://www.uspto.gov

Intellectual Property – <u>Copyrights:</u> Copyright is a form of protection to the authors of "original works of authorship," including literary, dramatic, musical, artistic, and certain other intellectual works. This protection is available to both published and unpublished works. Copyright generally gives the owner exclusive rights to the copyrighted instrument. http://www.copyright.gov/