

Final Project

Required Paper Format

First A. Author¹

Business or Academic Affiliation's Full Name 1, City, State, Zip Code, Country

Abstract (*approximately 200 words*)

These instructions give you guidelines for preparing papers for AIAA Technical Journals. Use this document as a template if you are using Microsoft Word 2001 or later for Windows, or Word X or later for Mac OS X. Otherwise, use this document as an instruction set. If you previously prepared an AIAA Conference Paper using the Papers Template, you may submit using the Papers Template so long as the text is double-spaced. Carefully follow the journal paper submission process in Sec. II of this document. Keep in mind that the electronic file you submit will be formatted further at AIAA. This first paragraph is formatted in the abstract style. Abstracts are required for regular, full-length papers and express articles. Be sure to define all symbols used in the abstract, and do not cite references in this section. The footnote on the first page should list the Job Title and AIAA Member Grade (if applicable) for each author.

Nomenclature (*example*)

Papers with many symbols may benefit from a nomenclature list that defines all symbols with units, inserted between the abstract and the introduction. If one is used, it must contain all the symbology used in the manuscript, and the definitions should not be repeated in the text. In all cases, identify the symbols used if they are not widely recognized in the profession. Define acronyms in the text, not in the nomenclature.

C_p	=	pressure coefficient
C_x	=	force coefficient in the x direction
C_y	=	force coefficient in the y direction
c	=	chord, cm
dt	=	time step, s
F_x	=	X component of the resultant pressure force acting on the vehicle, N
F_y	=	Y component of the resultant pressure force acting on the vehicle, N
α	=	angle of attack, deg
Θ	=	boundary-layer momentum thickness
ρ	=	density, g/cm^3

Subscripts

cg	=	center of gravity
G	=	generator body
iso	=	waypoint index

¹ Insert Academic Level, Department Name, and A number.

I. Introduction

THIS document is a template for Microsoft Word 2001 or later. The default font for the Template is Times New Roman, 10-point size. In the electronic template, use the “Text” style from the pull-down menu to format all primary text for your manuscript. The first line of every paragraph should be indented, and all lines should be double-spaced. Default margins are 1 in. on all sides. In the electronic version of this template, all margins and other formatting are preset. There should be no additional (blank) lines between paragraphs.²

II. Analysis

Enter Description of Analytical methods, and derivations here.

A. Oblique Shock Methods

B. Prandtl-Meyer Methods

C. Calculating C_L , C_D , L/D for Inviscid Flow

D. Incompressible Skin Friction Models

- Laminar
- Transitional
- Turbulent

E. Skin Friction Compressibility Corrections

- Laminar Flow Derivation
- 1/7th Power Law (Turbulent) Correction
- General (1/n) Power Law Correction

Equations are numbered consecutively, with equation numbers in parentheses flush right, as in Eq. (1). Insert a blank line both above and below the equation. First use the equation editor to create the equation. If you are using Microsoft Word, use either the Microsoft Equation Editor or the MathType add-on (<http://www.mathtype.com>) for equations in your paper, use the function (Insert>Object>Create New>Microsoft Equation *or* MathType Equation) to insert it into the document. Please note that “Float over text” should *not* be selected. To insert the equation into the document, do the following:

- 1) Select the “Equation” style from the pull-down formatting menu, and hit “tab” once.
- 2) Insert the equation, and hit “tab” again.
- 3) Enter the equation number in parentheses.

A sample equation is included here, formatted using the preceding instructions:

$$\int_0^{r_2} F(r, \varphi) dr d\varphi = [\sigma r_2 / (2\mu_o)] \int_0^\infty \exp(-\lambda|z_j - z_i|) \lambda^{-1} J_1(\lambda r_2) J_0(\lambda r_i) d\lambda \quad (1)$$

Be sure that symbols in your equation are defined in the Nomenclature or immediately following the equation. Also define abbreviations and acronyms the first time they are used in the main text. (Very common abbreviations such as AIAA and NASA, do not have to be defined.)

III. Results and Discussion

Present all plots and numerical calculations here. Be sure to follow proper format for figures. Including scales, axis units, and figure labels.

² NOTE: If you are using the Template to format your manuscript, the required spacing and formatting will be applied automatically, simply by using the appropriate style designation from the pull-down menu. Italics may be lost when you copy your text into the template.

F. Required Project Elements

- Proper Writeup Format All Required Elements: **10 pts** Max
- Laminar Compressibility Correction Derivation: **10 Points** Max
 - Compressibility Correction
 - Average Boundary Layer Temperature
- Inviscid L/D Plots and Supporting Analysis: **10 Points** Max
 - Pressure Distributions vs Alpha
 - CL, CD vs Alpha
 - L/D Max Vs Mach Number
- Viscous L/D Plot: 1/7th Power Law, Turbulent Skin Friction Only: **10 Points** Max
 - CL, CD vs Alpha
 - L/D Max Vs Mach Number, Altitude
- Transitional flow (laminar, transitional, and/or turbulent: **10 Points** Max)
 - *L/D max vs Mach and Reynolds Number Plot*
 - *Transition Points Identified*

G. Example Figure

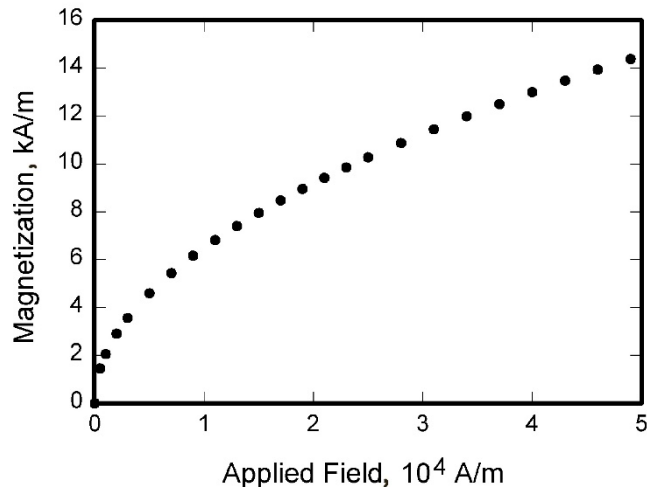


Fig. 1 Magnetization as a function of applied fields.

Line drawings must be clear and sharp. They must be large enough to be legible. *Use of colors to highlight details is encouraged.* Make sure that all lines and graph points are dark and distinct and that lettering is legible; 8- to 10-point type is suitable for artwork that is sized to fit the column width (3 ¼ in.). Keep the lettering size and style uniform both within each figure and throughout all of your illustrations. Place figure captions below each figure, and limit caption length to 20-25 words. If your figure has multiple parts, include the labels “a),” “b),” etc., below and to the left of each part, above the figure caption. Please verify that the figures and tables you mention in the text actually exist. When citing a figure in the text, use the abbreviation “Fig.” except at the beginning of a sentence.

Figures should have no background, borders, or outlines. In the electronic template, use the “Figure” style from the pull-down formatting menu to type caption text. You may also insert the caption by going to the Insert menu and choosing Caption. Make sure the label is “Fig.,” and type your caption text in the box provided. Captions are bold with a single tab (no hyphen or other character) between the figure number and figure description.

Use the Table drop-down menu to create your tables; See the Table 1 example for table style and column alignment. If you wish to center tables that do not fill the width of the page, simply highlight and “grab” the entire table to move it into proper position.

H. Example Table

Table 1 Transitions selected for thermometry

Line	Transition			Frequency, cm ⁻¹	<i>FJ</i> , cm ⁻¹	<i>Gv</i> , cm ⁻¹
	<i>v</i> ''		<i>J</i> ''			
a	0	P ₁₂	2.5	44069.416	73.58	948.66
b	1	R ₂	2.5	42229.348	73.41	2824.76
c	2	R ₂₁	805	40562.179	71.37	4672.68
d	0	R ₂	23.5	42516.527	1045.85	948.76

IV. Conclusion

Although a conclusion may review the main points of the paper, it must not replicate the abstract. A conclusion might elaborate on the importance of the work or suggest applications and extensions. Do not cite references in the conclusion. Note that the conclusion section is the last section of the paper to be numbered. The appendix (if present), funding information, other acknowledgments, and references are listed without numbers.

V. Bibliography

I. Footnotes

Footnotes, where they appear, are placed above the 1-in. margin at the bottom of the page. To insert footnotes into the template, use the Insert>Footnote feature from the main menu as necessary. Footnotes are formatted automatically in the template, but, if another medium is used, they should appear as superscript symbols in the following sequence: *, †, ‡, §, ¶, **, ††, ‡‡, §§, etc.

List and number all references at the end of the paper. Corresponding bracketed numbers are used to cite references in the text [1], including citations that are an integral part of the sentence (e.g., “It is shown in Ref. [2] that...”) or follow a mathematical expression: “ $A^2 + B = C$ (Ref. [3]).” For multiple citations, separate reference numbers with commas [4, 5], or use a dash to show a range [6–8]. Reference citations in the text should be in numerical order.

J. References

In the reference list, give all authors’ names; do not use “et al.” unless there are six authors or more. Papers that have not been published should be cited as “unpublished”; papers that have been submitted or accepted for publication should be cited as “submitted for publication.” Private communications and personal websites should appear as footnotes rather than in the reference list.

References should be cited according to the standard publication reference style. (For examples, see the “References” section of this template.) Never edit titles in references to conform to AIAA style of spellings, abbreviations, etc. Names and locations of publishers should be listed; month and year should be included for reports and papers. For papers published in translation journals, please give the English citation first, followed by the original foreign language citation.

The examples below illustrate different reference types, following AIAA style. If you are using the Word version of this Template, select the “references” style from the drop-down style menu to format your references. All references should be in 9-point font, with reference numbers in brackets. You are not required to indicate the type of reference; different types are shown here for illustrative purposes only.

The DOI (digital object identifier) should be incorporated in every reference for which it is available (see Ref. 1 sample); for more information on DOIs, visit www.doi.org or www.crossref.org.

Periodicals

- [1] Vatistas, G. H., Lin, S., and Kwok, C. K., “Reverse Flow Radius in Vortex Chambers,” *AIAA Journal*, Vol. 24, No. 11, 1986, pp. 1872, 1873.
doi: 10.2514/3.13046
- [2] Alyanak, E. J., and Pendleton, E., “Aeroelastic Tailoring and Active Aeroelastic Wing Impact on a Lambda Wing Configuration,” *Journal of Aircraft*, published online 10 Nov. 2016.
doi: 10.2514/1.C033040
- [3] Dornheim, M. A., “Planetary Flight Surge Faces Budget Realities,” *Aviation Week and Space Technology*, Vol. 145, No. 24, 9 Dec. 1996, pp. 44–46.
- [4] Terster, W., “NASA Considers Switch to Delta 2,” *Space News*, Vol. 8, No. 2, 13–19 Jan. 1997, pp. 1, 18.

All of the preceding information is required. The journal issue number (“No. 11” in Ref. 1) is preferred, but the month (Nov.) can be substituted if the issue number is not available. Use the complete date for daily and weekly publications. Transactions follow the same style as other journals.

Books

- [5] Peyret, R., and Taylor, T. D., *Computational Methods in Fluid Flow*, 2nd ed., Springer-Verlag, New York, 1983, Chaps. 7, 14.
- [6] Oates, G. C. (ed.), *Aerothermodynamics of Gas Turbine and Rocket Propulsion*, AIAA Education Series, AIAA, New York, 1984, pp. 19, 136.
- [7] Volpe, R., “Techniques for Collision Prevention, Impact Stability, and Force Control by Space Manipulators,” *Teleoperation and Robotics in Space*, edited by S. B. Skaar and C. F. Ruoff, Progress in Astronautics and Aeronautics, AIAA, Washington, DC, 1994, pp. 175–212.

Publisher, place, and date of publication are required for all books. No state or country is required for major cities: New York, London, Moscow, etc. A differentiation must always be made between Cambridge, MA, and Cambridge, England, UK. Note that series titles are in Roman type.

Proceedings

- [8] Thompson, C. M., “Spacecraft Thermal Control, Design, and Operation,” *AIAA Guidance, Navigation, and Control Conference*, CP849, Vol. 1, AIAA, Washington, DC, 1989, pp. 103–115
- [9] Chi, Y. (ed.), *Fluid Mechanics Proceedings*, NASA SP-255, 1993.
- [10] Morris, J. D., “Convective Heat Transfer in Radially Rotating Ducts,” *Proceedings of the Annual Heat Transfer Conference*, edited by B. Corbell, Vol. 1, Inst. of Mechanical Engineering, New York, 1992, pp. 227–234.

Reports, Theses, and Individual Papers

- [11] Chapman, G. T., and Tobak, M., “Nonlinear Problems in Flight Dynamics,” NASA TM-85940, 1984.
- [12] Brandis, A. M., Johnston, C. O., and Cruden, B. A., “Nonequilibrium Radiation for Earth Entry,” AIAA Paper 2016-3690, June 2016.
- [13] Steger, J. L., Jr., Nietubicz, C. J., and Heavey, J. E., “A General Curvilinear Grid Generation Program for Projectile Configurations,” U.S. Army Ballistic Research Lab., Rept. ARBRL-MR03142, Aberdeen Proving Ground, MD, Oct. 1981.
- [14] Tseng, K., “Nonlinear Green’s Function Method for Transonic Potential Flow,” Ph.D. Dissertation, Aeronautics and Astronautics Dept., Boston Univ., Cambridge, MA, 1983.

Government agency reports do not require locations. For reports such as NASA TM-85940, neither insert nor delete dashes; leave them as provided. Place of publication *should* be given, although it is not mandatory, for military and company reports. Always include a city and state for universities. Papers need only the name of the sponsor; neither the sponsor’s location nor the conference name and location is required. *Do not confuse proceedings references with conference papers.*

Electronic Publications

Regularly issued electronic journals and other publications are permitted as references. Include the doi if provided; otherwise provide the full URL. Archived data sets also may be referenced as long as the material is

openly accessible and the repository is committed to archiving the data indefinitely. References to electronic data available only from personal websites or commercial, academic, or government ones where there is no commitment to archiving the data are not permitted in the reference list.

[15] Atkins, C. P., and Scantelbury, J. D., "The Activity Coefficient of Sodium Chloride in a Simulated Pore Solution Environment," *Journal of Corrosion Science and Engineering* [online journal], Vol. 1, No. 1, Paper 2, URL: <http://www.cp.umist.ac.uk/JCSE/vol1/vol1.html> [retrieved 13 April 1998].

[16] Vickers, A., "10-110 mm/hr Hypodermic Gravity Design A," *Rainfall Simulation Database* [online database], URL: <http://www.geog.le.ac.uk/bgrg/lab.htm> [retrieved 15 March 2006].

Break website addresses after punctuation, and do not hyphenate at line breaks.

Computer Software

[17] TAPP, Thermochemical and Physical Properties, Software Package, Ver. 1.0, E. S. Microware, Hamilton, OH, 1992.

Include a version number and the company name and location of software packages.

Patents

Patents appear infrequently. Be sure to include the patent number and date.

[18] Scherrer, R., Overholster, D., and Watson, K., Lockheed Corp., Burbank, CA, U.S. Patent Application for a "Vehicle," Docket No. P-01-1532, filed 11 Feb. 1979.

Private Communications and Websites

References to private communications and personal website addresses are not permitted. They may, however, be incorporated into the main text of a manuscript or may appear in footnotes.

Unpublished Papers and Books

Unpublished works can be used as references as long as they are being considered for publication or can be located by the reader (such as papers that are part of an archival collection). If a journal paper or a book is being considered for publication, choose the format that reflects the status of the work (depending upon whether it has been accepted for publication):

[19] Doe, J., "Title of Paper," *Name of Journal* (to be published).

[20] Doe, J., "Title of Chapter," *Name of Book*, edited by..., Publisher's name and location (to be published).

[21] Doe, J., "Title of Work," Name of Archive, Univ. (or organization), City, State, Year (unpublished).

Unpublished works in an archive *must* include the name of the archive and the name and location of the university or other organization where the archive is held. Also include any cataloging information that may be provided.