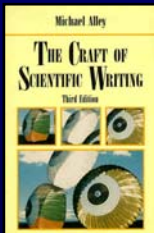


Structure in Scientific Writing

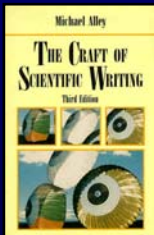
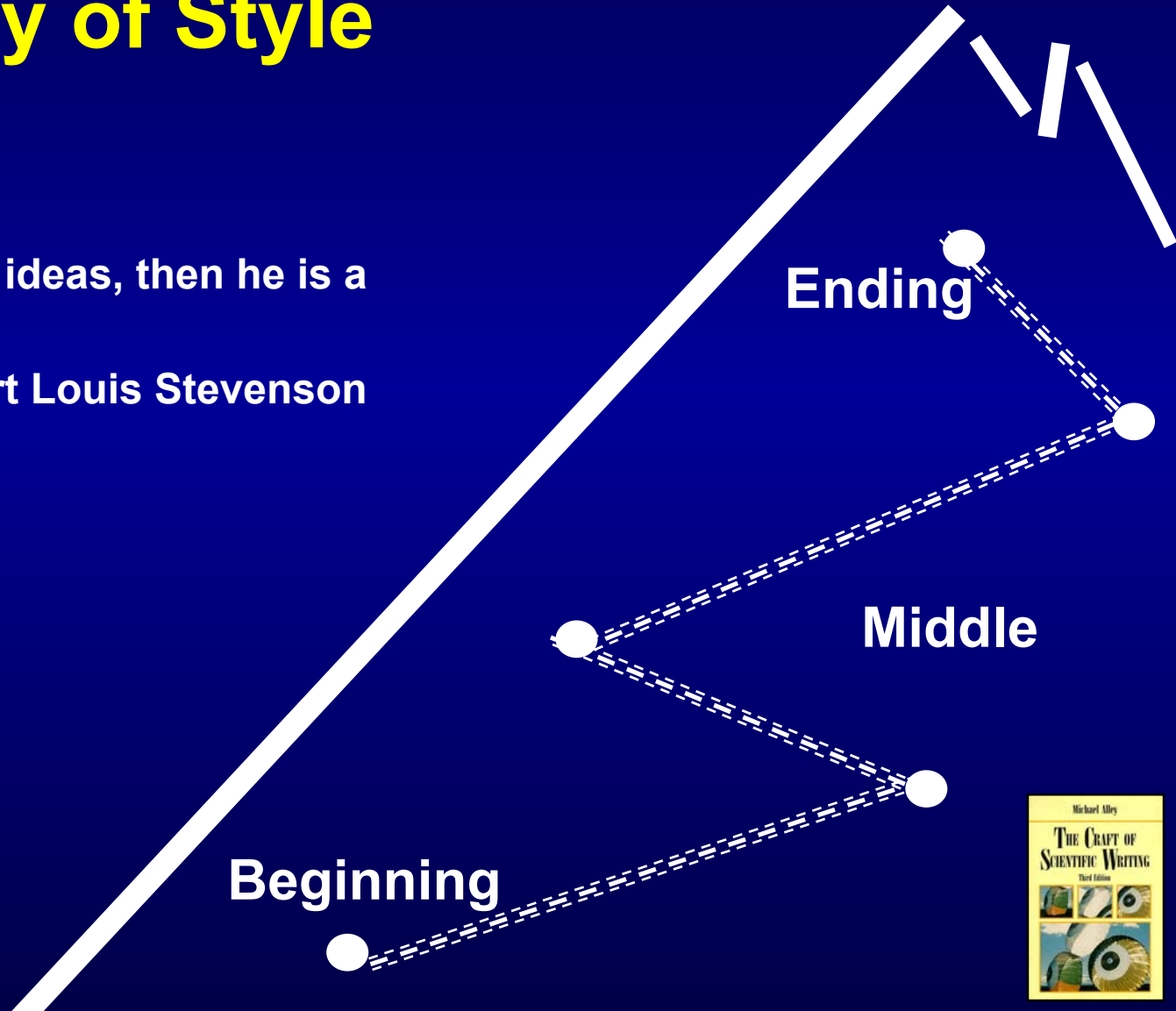
These slides, which are used in graduate and undergraduate engineering courses at Virginia Tech, come from Chapters 2 and 3 in *The Craft of Scientific Writing* (3rd ed., Springer-Verlag).



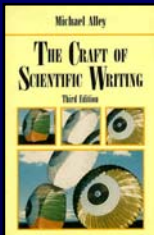
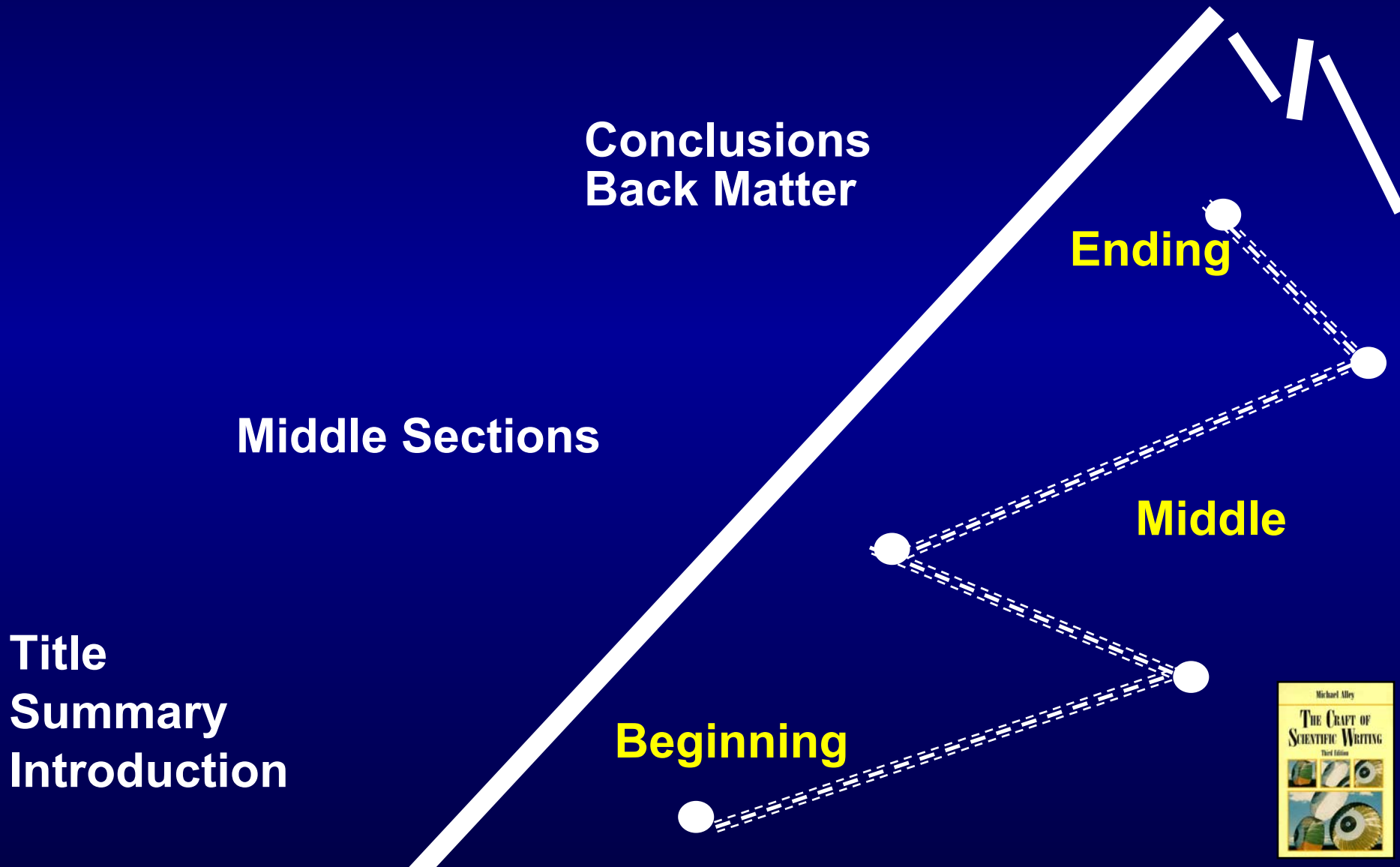
Structure: the Strategy of Style

If a man can group his ideas, then he is a
writer.

Robert Louis Stevenson



The organization of a scientific document can be viewed as a beginning, middle, and ending

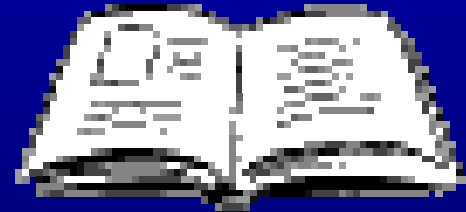


Beginnings prepare readers for understanding the work

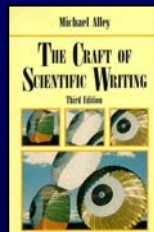
Title orients readers to document



Summary tells readers what happens in document



Introduction prepares readers for the middle

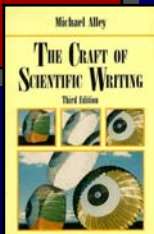


A strong title orients readers to your area of work

Effects of Humidity
on the Growth
of Avalanches



Effects of Humidity
on the Growth
of Electron Avalanches
in Electrical Gas Discharges

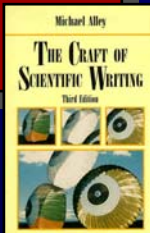


A strong title also separates your work from everyone else's work

**Studies on the
Electrodeposition
of Lead on Copper**



**Effects of Rhodamine-B
on the Electrodeposition
of Lead on Copper**



Several names for summaries exist

Summary

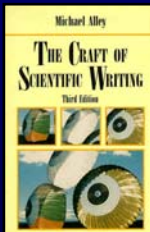
Technical
Abstract

Informative
Abstract

Abstract

Descriptive
Abstract

Executive
Summary



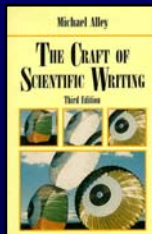
Although several names exist for summaries, there are essentially two approaches

This paper describes a new inertial navigation system for mapping oil and gas wells. In this paper, we will compare the mapping accuracy and speed for this new system against the accuracy and speed for conventional systems.

Descriptive

This paper describes a new inertial navigation system that will increase the mapping accuracy of oil wells by a factor of ten. The new system uses three-axis navigation that protects sensors from high-spin rates. The system also processes its information by Kalman filtering (a statistical sampling technique) in an on-site computer. Test results show the three-dimensional location accuracy is within 0.1 meters for every 100 meters of well depth, an accuracy ten times greater than conventional systems.

Informative



A document's introduction prepares readers for the discussion

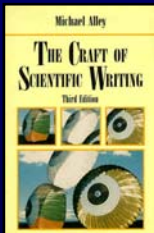
Topic?

Importance?

Background?

Arrangement?

Introduction



The introduction defines the scope and limitations of the work

Women may not experience the same effects

Medical histories not considered

scope

**Proposed Study
on Effects of Alcohol
on Life Expectancy**

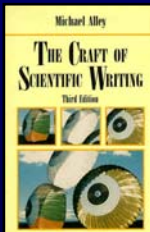
Ten-year study

Three classes of drinkers:
non-drinkers
moderate drinkers
heavy drinkers

Men surveyed

Other effects, such as exercise, not considered

limitations

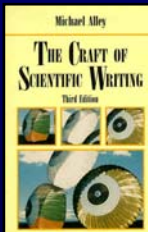


A strong introduction tells readers why the research is important

This paper presents a design for a platinum catalytic igniter in hydrogen-air mixtures. This igniter has application in nuclear reactors. One danger at a nuclear reactor is a loss-of-coolant accident. Such an accident can produce large quantities of hydrogen gas when hot water and steam react with zirconium fuel rods. In a serious accident, the evolution of hydrogen may be so rapid that it produces an explosive hydrogen-air mixture in the reactor containment building. This mixture could breach the containment walls and allow radiation to escape.

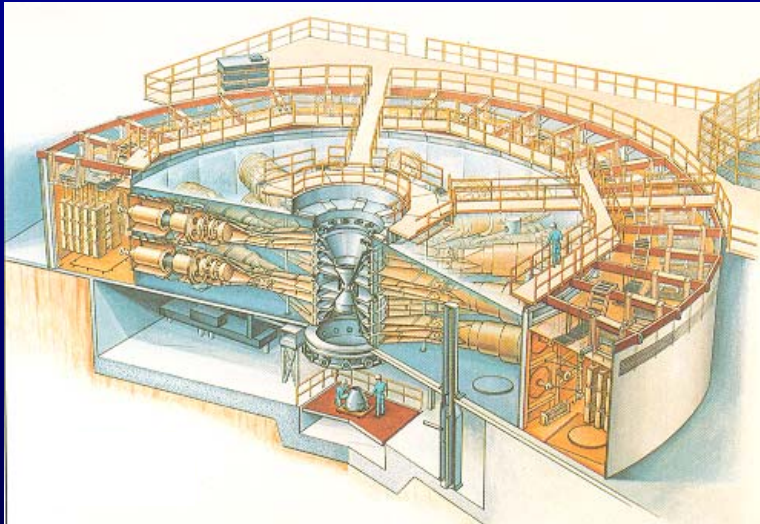
Our method to eliminate this danger is to intentionally ignite the hydrogen-air mixture at concentrations below those for which any serious damage might result.

importance



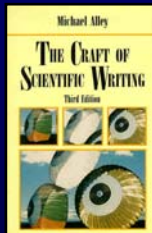
In the middle of a report, you present your work

Choose a logical strategy



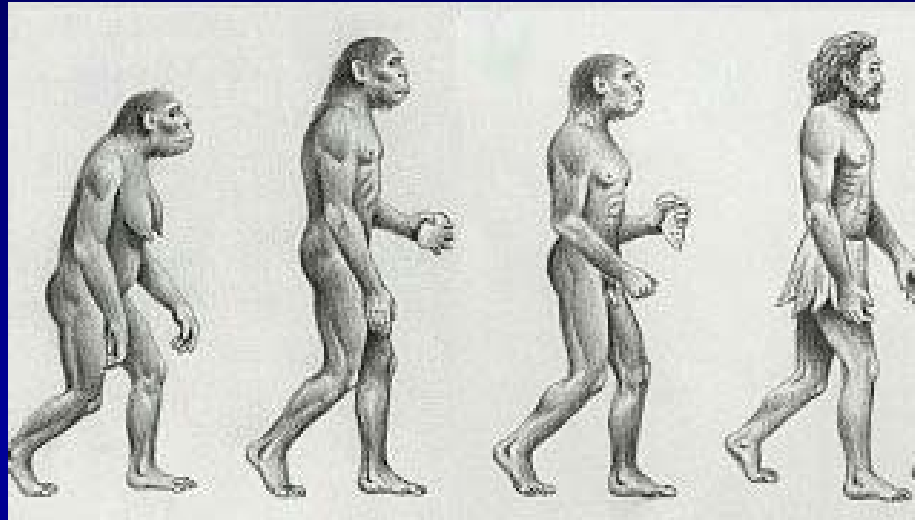
Make sections and subsections

Heading
Subheading
Subheading
Heading
Subheading
Subheading
Subheading
Heading

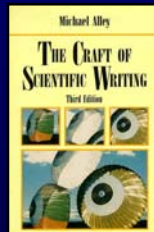
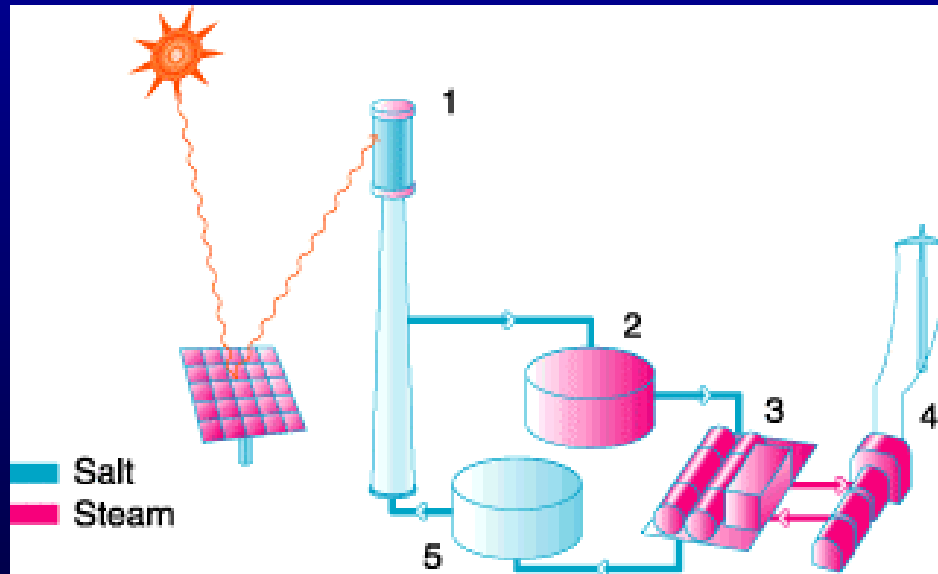


Common strategies exist for the middles of scientific reports

Chronological

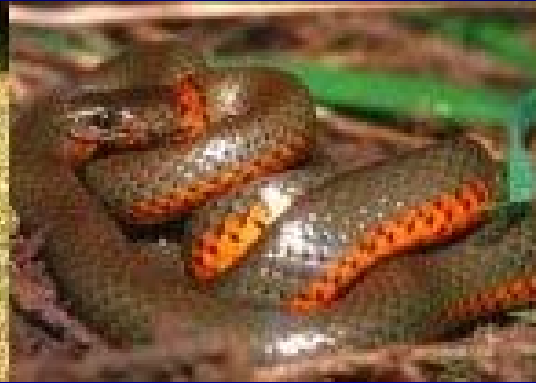


Flow

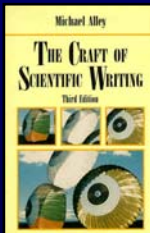
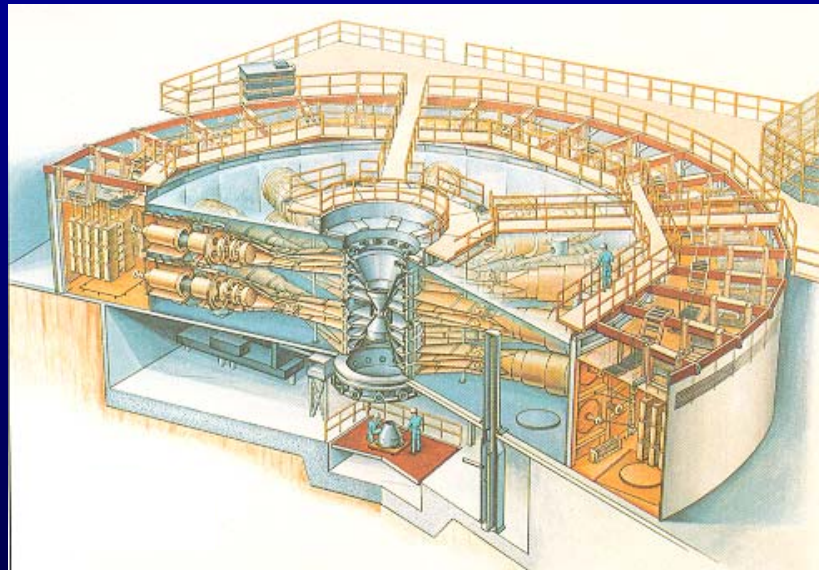


Common strategies exist for the middles of scientific reports

Parallel Parts



Spatial



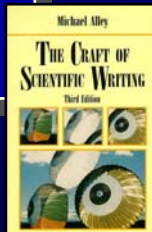
Section headings should be descriptive and parallel

Non-Parallel Non-Descriptive

Introduction
Background
Marx Generators
Line Pulse
Beam Generation
Transporting Beam
Pellets
Results
Conclusions

Parallel Descriptive

Introduction
Past Designs for Particle Beam Fusion
New Design for Particle Beam Fusion
 Charging Marx Generators
 Forming Line Pulse
 Generating Particle Beam
 Transporting Particle Beam
 Irradiating Deuterium-Tritium Pellets
Results of New Design
Conclusions and Recommendations



**When you divide a section into subsections,
all the pieces should be of the same pie**

Calculations for Fan Performance

Calculations of Volumetric Flow Rate

Calculations of Fluid Power

Calculations of Efficiency



Organization is hidden when headings occur in a long list without secondary headings

Performance of the Solar One Receiver

Introduction

Steady State Efficiency

Average Efficiency

Start-Up Time

Operation Time

Operation During Cloud Transients

Panel Mechanical Supports

Tube Leaks

Conclusion

Performance of the Solar One Receiver

Introduction

Receiver's Efficiency

Steady State Efficiency

Average Efficiency

Receiver's Operation Cycle

Start-Up Time

Operation Time

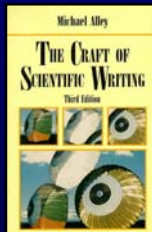
Operation During Cloud Transients

Receiver's Mechanical Wear

Panel Mechanical Supports

Tube Leaks

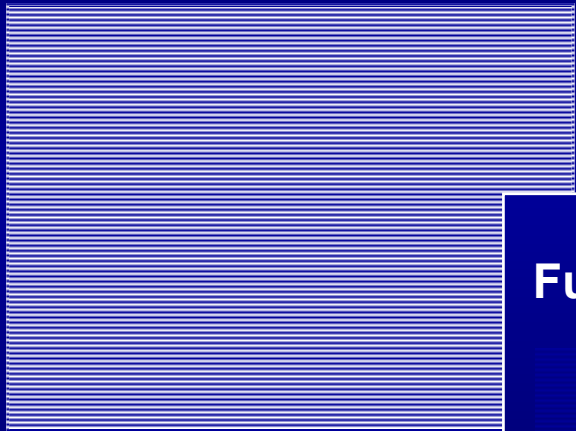
Conclusion



In a strong ending, you analyze results and give a future perspective

Conclusions

Analysis of Results

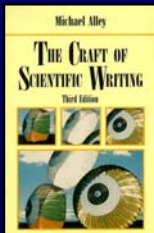


Analyze results from overall perspective

Future Perspective



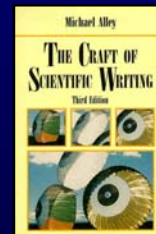
*Several options:
Make recommendations
Discuss future work
Repeat limitations*



Use appendices to supply background for secondary audiences

Appendix A Concern About the Greenhouse Effect

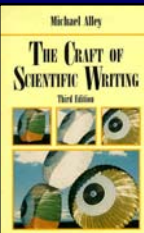
For almost a hundred years, experts have been concerned with the increasing concentrations of gases such as carbon dioxide, methane, and nitrogen oxides in the earth's lower atmosphere. These gases are natural by-products of combustion. Figure A-1 illustrates the correlation between global temperature and carbon dioxide concentrations...



Use appendices to supply secondary or tangential information to primary readers

Appendix B Project Stormfury

In 1961, the United States Weather Bureau and the Department of Defense (Navy) began a project to reduce the strength of hurricanes. The project, called Project Stormfury, uses cloud seeding, a process used to produce rainfall and reduce hail in thunderstorms. In Project Stormfury, silver iodide crystals, similar in structure to ice, are dispersed by airplanes in the upper reaches of cloud formations just outside the hurricane's eye where the winds are highest. Initial results showed that wind speeds decreased between 15–30% after seedings...



For secondary readers, use a glossary to define unfamiliar terms

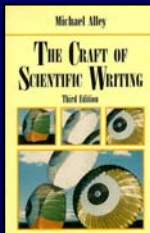
Glossary

burst point: the exact point in space where an atomic bomb is detonated.

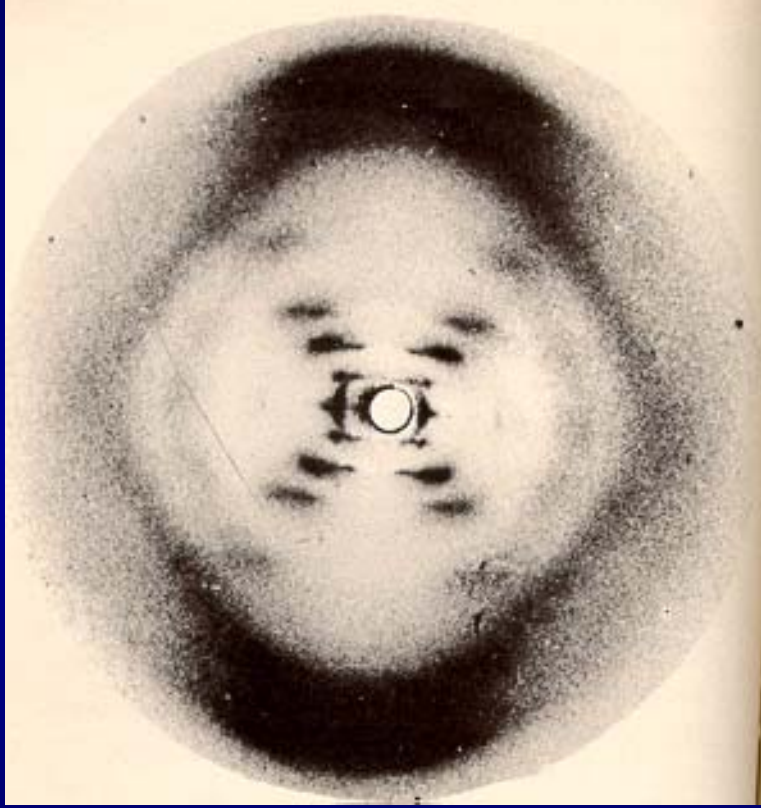
clear visibility: a viewing range of twenty miles.

fallout: the descent to the Earth's surface of radioactive particles from a cloud contaminated with the fission products of a nuclear explosion.

hypocenter: the point on the earth's surface directly below the burst point; also called ground zero.



Failing to cite the contribution of others can be a fatal flaw in your career



James Watson surreptitiously looked at Rosalind Franklin's work



Watson did not give enough credit to Franklin