Mission Statement:

The College of Sciences provides undergraduate and graduate education grounded in fundamentals to prepare students to apply scientific principles creatively and responsibly. The College of Sciences generates knowledge through research, applies that knowledge to scientific and technological problems and disseminates the findings to benefit the Commonwealth of Virginia, the nation and society at large. Interdisciplinary initiatives, including the establishment of strategic research centers, facilitate cross-disciplinary interactions between faculty and students, and serves as incubators for future growth of the College.

Vision Statement:

The College of Sciences strives to be a leader in research and education, attracting leading scholars and providing a rich educational experience for students. The faculty of the College will continue to provide innovative, high quality teaching to our students. The College will further enhance its national and international recognition for its scholarly endeavors by conducting high level research, supported by peer reviewed external funding and publishing in highly regarded journals. Our graduates will continue to be well prepared for success thereby providing evidence of the effectiveness of the educational program in the College. The College of Sciences will further strengthen its strong ties to and substantial financial impact on the community, the region, the Commonwealth, the nation and internationally.

SWOT analysis:

1) Strengths:

A) Increase in COS majors

Freshman enrollments increased by 9% from 2007 to 2008 across the university, while majors in the College increased by 41% during that same time period. This increase in majors is evidence of the strength of our programs.

B) Increased undergraduate enrollment

Freshman enrollments increased by 9% from 2007 to 2008. These new enrollments have significantly increased our teaching responsibilities since many of the first year courses in the COS have seen enrollment increases greater than 9%. Overall, enrollments (headcounts) in the College of Sciences courses were increased by 19% (Fall 2007: 15,690 versus Fall 2008: 18,734) and student credit hours were increased by 21% (Fall 2007: 47,388 versus Fall 2008: 57,428) (Fall, 2008).

The chart below lists the first year courses offered through the College and the percent change in enrollment from 2007 to 2008.

Biol		Chem		CS		Math		OEAS		Phys		Psych	
Course	% change	Course	% change	Course	% change	Course	% change	Course	% change	Course	% change	Course	% change
108	10	101	29	101	1	101	-8	106	12	101	45	201	58
115	4	115	13	149	18	102	262	110	45	103	5	203	22
250	17			150	15	162	-7	111	49	111	4		
						163	-4			231	-4		
						Stats 130	37						

C) Strong undergraduate teaching programs

The undergraduate teaching program provides quality programs for our majors as well as supporting courses for the other colleges particularly Engineering, Health Sciences and Business. The strength of our programs can be evidenced by the high proportion of students accepted into graduate and professional schools and the number of faculty who have received teaching awards.

Several faculty members have been recognized by the State Council of Higher Education of Virginia for Excellence in teaching. In recent years Larry Weinstein , from the Department of Physics and John Adam from the Department of Mathematics and Statistics were recognized.

Several faculty members have been designated University Professors in recognition of their contributions to teaching and research at Old Dominion including Al Savitzky and Jim Swanson from the Department of Biology and Larry Weinstein and Des Cook from the Department of Physics.

Other faculty teaching awards include: Mark Butler, Department of Biology who won the Hirschfield Faculty Excellence Award and Kent Carpenter, Department of Biology who won the Provost Award for Leadership in International Education.

D) Graduate student/faculty ratios (typically, 3-4)

The graduate student/faculty ratio n the College averages 3-4 students per faculty member. This ratio has been an important factor in maintaining the quality of the research and graduate program in sciences.

E) Grad students mentored/degrees conferred

The departments within the COS each have robust PhD programs. The average head count for these is approximately 20 students enrolled in a given year, and number of degrees conferred ranges between 2 and 6 in most years. Given the depth of training involved with our PhD students, and our overall resources, we believe that these are

very reasonable figures. Each of our GPDs indicated that their programs could undergo moderate growth, but only if University resources are proportionately expanded.

F) Faculty

The College of Sciences employs 132 tenure track faculty, 4 research faculty and 26 instructors. These faculty members are recognized in their respective fields, and are highly productive, as documented below.

G) Faculty Scholarship: Publications, citation and service

The departments in the COS are highly productive as measured by both the numbers of publications and the impact of those contributions. As an illustration, the Department of Physics generated over 100 publications last year. This is typical of the productivity over the past 3 years in the COS. Additionally, faculty members have published in such high-profile journals as *Science* and *Nature*.

Many of our faculty members have over 1000 citations, several have over 3,000. These numbers show the impact that the COS faculty have on their respective professional fields. Additionally, a large number of faculty members have given an invited talk.

Faculty members in the COS sit on editorial boards of their professional organization. On average, approximately ten faculty members in each department hold responsibilities on editorial boards.

H) National and International Awards: many of the faculty members in the COS have been recognized for their accomplishments, just a few are highlighted below:

Daniel Sonenshine, professor emeritus and eminent scholar of the Department of Biological Sciences was awarded one of the highest honors in his field of ticks and tick-borne diseases: the Hoogstraal Medal for outstanding lifelong service internationally in medical entomology.

Steven Olariu, Department of Computer Science received the best paper award at the Fifth International Conference on Advances in Mobile Mulitmedia.

Drs. Wahab and (received the best paper award at the Third International Computer Engineering Conference Cairo University.

Cynthia Jones, Department of Ocean, Earth and Atmospheric Sciences was awarded Virginia Scientist of the Year and SCHEV Professor of the Year.

Larry Atkinson, Department of Ocean, Earth and Atmospheric Sciences is an AAAS Fellow.

Nora Noffke, Department of Ocean, Earth and Atmospheric Sciences is the recipient of the James Lee Wilson Medal for Geosciences from the Geological Society of America.

Anatoly Radyushkin, Department of Physics won the Alexander von Humboldt Award for Senior Scientists in the US.

Anatoly Radyushkin, Department of Physics won the Virginia Scientist of the Year Award.

Eleven faculty members in the Department of Physics have been appointed as Fellows of the American Physical Society.

Four faculty in the Department of Physics hold elected offices for their respective professional organizations.

Dr. Karin Orvis, Department of Psychology has won 2 Dissertation awards from the American Society for Training and Development.

Dr. Poornima Madhavan won 2nd Prize for Excellence in Modeling and Simulation from VMASC.

I) Increased recruitment of funded faculty members

This year the College recruited twelve new faculty members (eleven tenured/tenure track and one research faculty member). Seven of these twelve faculty members are funded by federal peer-reviewed research grants (NSF, Department of Energy and NASA). These research grants have been transferred or are being transferred to ODU. Among the faculty members recruited in 2008 is Dr. Desh Ranjan, the new Chair of the Department of Computer Science and the Director of the proposed Center for Bioinformatics. Dr. Ranjan is an internationally known Computer Scientist with an extensive record of seminal discoveries and substantial research grant support. He is/has been the principal investigator or the co-principal investigator of several peer-reviewed research grants, principally from NSF, totaling approximately $12 million.

These faculty recruitments are part of a focused recruitment strategy. The faculty recruitments that we carried out in 2008 reflect a new recruitment strategy and a change of culture for the College of Sciences and the University which is focused in recruiting nationally/ internationally known scientists who will bring their grants to ODU, instead of recruiting mostly newly graduated assistant professors or even ABDs. The objective of this strategy is to increase research and research support. These faculty recruitment strategies will help to propel the College of Sciences to substantially higher levels of research and research support and demonstrates that COS can attract highly accomplished new faculty members.

J) Research Productivity and increased grant support:

NSF rankings and projected for 5 years from now:

Biological Sciences:	190; project 10% improvement	= 170
Chemistry:	126	= 113
CS:	102	= 90
Math/Stats:	81	= 72
OEAS:	96	= 90
Physics:	102	= 90
Psychology:	114	= 100

Over the 5-year period, FY03 – FY08, grant expenditures in the COS increased 29.4%. As the table below indicates, most of this growth occurred over the past two years, FY06-FY08. We attribute this to our successful recruitment of highly productive researchers to our campus.

Table: COS Research Expenditures over the past 5 years

Year	FY03	FY04	FY05	FY06	FY07	FY08
$M	10.2	9.8	9.9	11	11	13.2

The largest proportion of grant expenditures in the University is contributed by the COS (31% of total expenditures). Additionally, the average indirect cost average of COS grants is 25.3%, which is the highest indirect cost of all academic units expending at least $1M.

Data released by ODURF demonstrates that grant awards to the College of Sciences have been increased by 11.8% this year to a record high of $12.78 million versus last year and research grant expenditures have increased this year by 19% to $13.2 million.

K) Centers

CCPO

The Center for Coastal Physical Oceanography (CCPO) was established in 1991 with Commonwealth funding as a center of excellence in coastal physical oceanography, within the Department of Ocean, Earth and Atmospheric Sciences. CCPO is internationally known as an active research center in physical oceanography. We host 2 to 4 international conferences or workshops each year. There are currently 6 faculty members, securing roughly $1M per year of external funding, attached to CCPO. We maintain a computer cluster with over 200 cpu. This is being applied to a variety of fluid

dynamical problems ranging from coastal and estuarine circulation to small scale turbulence to ecosystem models and genetics. We are active in the analysis of winds over the coastal ocean as a source of electrical power. We are helping develop criteria for the development of possible wind energy locations over the coastal ocean and analyzing the environmental effects of such wind turbines. Additionally, we are active in installing and running ocean current measuring radar for the southern Chesapeake Bay and over the adjacent coastal ocean.

Center for Quantitative Fisheries Ecology

CQFE is internationally known as an active research center in quantitative fisheries ecology. We host international workshops frequently, host visiting scientists from other nations, train fisheries professionals worldwide in non-degree venues. There are currently 3 PhD scientists (1 faculty, 1 SSRP, 1 Postdoc) securing almost $1M per year of external funding who work out of CQFE. We are active in advising the state, region, and nation on the use of its fisheries resources sustainably. This is done through our work with the Virginia Marine Resources Commission, as technical advisors to the Atlantic States Marine Fisheries Commission, as member of the Mid-Atlantic Fisheries Management Council's Scientific and Statistics Committee (which sets the annual catch quotas for the regional fisheries), and as members of numerous committees of the National Research Council, among other activities. We are leaders in the field of using natural tags to measure survival and connectivity in fish populations worldwide. This is an essential method for evaluating the effect that climate change will have on fish populations.

COSMIC

The COSMIC center has developed the following list of objectives:

- To provide researchers and students access to major state-of-the-art instrumentation in a user friendly teaching/research environment and to provide an advanced analytical service dedicated to environmental, biomedical, biological and chemical analyses.
- To encourage collaborations and partnerships between Old Dominion University researchers and researchers at local, state, US, and international universities and agencies, thereby heightening public recognition of research at Old Dominion University.
- To help with the establishment of major research focus groups at Old Dominion University, in areas like biogeochemistry and environmental toxicology.
- To increase the ability of Old Dominion University to seek and obtain research funding from public funding agencies and private companies.

Since its inception in July 2006 COSMIC has aided researchers in obtaining funding by providing needed analytical analysis. Six grant proposals in which Old Dominion University faculty have participated have been funded for a total of $1,489,440.

COSMIC currently receives samples from ODU and external research labs daily. COSMIC has provided analytical research services to seventy five different research groups. Sixty eight (90.6%) of these groups were from colleges and universities, 15 groups (20%) from Old Dominion University, 49 groups (65.3%)from other U.S. colleges and universities, and four groups(5.3%) from international universities. The other groups (9.3%) included six private companies and one U.S. government agency.

Since the beginning of FY2009, time usage of the laboratory by groups from Old Dominion University has been 57% of the total usage. Outside groups accounted for 43% of the total usage. Since the beginning of FY2009, revenue invoiced for analyses done for groups from Old Dominion University has been 48% of the total revenue invoiced. Revenue invoiced to outside groups has accounted for 52% of the total revenue invoiced. Outside groups are charged higher fees for their analyses.

Jefferson Lab

The partnership between COS and Jefferson Lab has provided resources to grow the Physics Department and enabled ODU to recruit quality faculty and graduate students. The new initiative in Accelerator Science is interdisciplinary in nature and will ultimately benefit the entire college. Currently Jefferson Lab is supporting 12 graduate students in nuclear, atomic and accelerator physics. They pay for ½ the salaries of the five nuclear theorists and will pay for ½ of the new Accelerator Center Director. Finally there are 6 Jefferson Lab professors who are staff members at the lab with full ODU faculty privileges. They can spend up to 1/3 of their time on ODU activities. The relationship with Jefferson Lab will continue to bring new opportunities to the College.

L) Retention initiatives

This year, the Math Science Resource Center (MSRC) was established to improve student performance in Math and Science courses. An analysis of the results from one semester indicate that students in Math 102, Math 162 and Chemistry 115 who received services from the MSRC, earned statistically significant higher average course grades and reported statistically significant fewer DFWI grades. Our retention initiatives were supported by additional funds provided by the Provost. This modest investment, less than 1% of the State budget of the College, has had a major impact in its initial semester. Initiatives started from the program include:

a. Recitations were introduced into Math 102 and 162 in the Fall 2008.
b. Tutoring on demand was offered to students by appropriately selected, trained and supervised peer-tutors (honors or senior students) or by graduate students.
c. Tutoring on-line offered to students on a 24hr basis.
d. Peer-led self-study groups.

During the Fall 2008 semester we targeted students taking Math 102, Math 162 and Chemistry 115. The total student enrollment in these three courses was 3,343. Highlights of the results from these interventions are shown below.

Math 162 (887 students; Fall 2008)

- The DFWI rate for students who received interventions from the MSRC was significantly lower (39.9%) in comparison to the DFWI rate (50.8%) of the students who did not receive interventions from the MSRC. This difference is statistically significant ($p = 0.008$).
- The overall DFWI rate (percentage of all students receiving a grade of D, W, F or I) in Math 162 dropped from 58% in the Fall of 2007 (922 students) to 48.4% in the Fall of 2008 (887 students). This difference is statistically significant ($p < 0.001$). The DF rate during the same period dropped from 45% (Fall 2007) to 33% (Fall 2008) ($p < 0.001$).
- Students who used the MSRC services earned significantly higher average grades (mean±SD: 2.06±1.33) than students who did not use the services offered by MSRC (mean±SD: 1.73±1.34). This difference is statistically significant ($p = 0.004$).

Math 102 (1,790 students; Fall 2008)

- Students with low Math SAT scores (450 or less) who used MSRC services earned significantly higher average grades (mean±SD: 2.02±1.25) than students with low SAT scores who did not use MSRC services (mean±SD: 1.50±1.35) ($p = 0.019$).
- DFWI rate of students with low Math SAT scores (450 or less) who used MSRC services was 36.7%. In contrast, the DFWI rate of students with low Math SAT scores (450 or less) who did not use MSRC services was 57.9%. This difference is statistically significant ($p = .006$).
- DF rate of students with low Math SAT scores (450 or less) who used MSRC services was 24.5%. In contrast, the DF rate of students with low Math SAT scores (450 or less) who did not use MSRC services was 43.2%. This difference is statistically significant ($p = 0.017$).
- Students with low Math SAT scores (450 or less) were significantly ($p = 0.002$) more likely to seek assistance from the MSRC than students with high Math SAT scores (greater than 450).

Chemistry 115 (666 students; Fall 2008)

- Students who participated in online tutoring earned significantly higher average grades (2.78) in Chemistry 115 than students who did not participate (2.24), $p = 0.016$.
- The DFWI rate in Chemistry 115 was lower for students who received services from the MSRC (41.3%) than students who did not receive services (46.4%) (not significant). The DFWI rate was significantly lower for students who participated in online tutoring (30.5%) than students who did not participate in tutoring (46.4%),

p=0.021. The DF rate was significantly lower for students who participated in online tutoring (8.5%) than students who did not participate in tutoring (23.6%), *p*=0.01.

2) Weakness:

A) Lack of services and infrastructure for research, including key personnel

The COS lacks the key personnel to provide support in the form of instrument repair, electronic repair and machine shop services. This lack of support will hinder the College's ability to successfully compete for large center or training grants.

B) Lack of ability to attract substantial funding from NSF and NIH for major centers

To take the College to the next level of funding, multimillion dollar center grants, program project grants and similar grants, the College needs to improve its infrastructure, particularly in the area of core facilities. Although the equipment and instrumentation required by these grants may be in place, the support for the technical personnel to provide services is not at a necessary level to successfully compete for these grants.

C) Reduced NPS funding

Because of continued reductions in the Commonwealth's budgets, the NPS funding for departments has been continually shrinking. Since the time of the last strategic plan, the NPS budgets in the departments have fallen, in some cases by as much as 30%. Note too that those units who show a similar total dollar amount of NPS over the past 5 yrs, have nonetheless lost ground owing to inflation (7-8% for scientific products).

D) Support of grad students from faculty grants

In most departments nearly all of the graduate students are supported. Funding for graduate students is critical in order to stay competitive and attract the best graduate students. Currently, about one-half of the graduate students in the departments are support through grant funding. That number needs to increase and will if the College obtains a large center grant, training grant or program project grants.

3) Opportunity:

A) 2009 Recovery Act funding

The 2009 Economic Recovery Act includes funds to support research in several fields aligned to areas of research strengths in the College of Sciences including $10B for NIH,

$230 million for NOAA, $2.5 billion for NSF and $3.4 billion for DOE to name a few. This will give the COS the opportunity to obtain more funding, including graduate student training grants (IGERT, GAANN, T32 from NIH). This increase in funding will also provide the opportunity to hire high quality, well funded faculty from soft money institutions, including medical schools, universities and private research laboratories.

Additionally, there will be a significant investment in NOAA, NSF and NASA for climate-related environmental science even beyond the recovery act, and the COS (OEAS, Chemistry, Biology & Physics) is poised to benefit significantly from this change in federal policy.

B) Regional area:

The greater Hampton Roads area provides numerous opportunities for the College of Sciences.

The natural area contains unique sites in which to pursue research in Biological Sciences, coastal processes and hydrology such as the Chesapeake Bay, Dismal Swamp and Eastern Shore.

The military presence has provided opportunities for partnerships in research and education endeavors including Distance Learning programs in the past and can continue to do so.

Partnerships in research and education with Eastern Virginia Medical School can be expanded.

Several large school districts, many that are designated as Title I can provide opportunities for educational research and partnership. The COS has proposed a professional development program (PDP) for teachers that will provide extensive training of high school and middle school teachers in the science subjects that they teach through the offering of mathematics, chemistry, biology, physics, ocean/earth sciences and computer sciences courses. It is assumed that all teachers have extensive pedagogical training therefore these courses will only address subject matters. These courses may be offered during weekends, evenings or during summers. In addition, several courses may be offered through distance learning. PDPs in chemistry, biology, physics, ocean/earth sciences and computer science will also provide laboratory modules which will be designed and taught to the teachers at ODU covering methods and material that can be immediately used in the high schools and middle schools using facilities typically available in these schools. High and middle school teachers from the Tidewater Area, as well as teachers from the Commonwealth of Virginia and in

particular the western and southern parts of the state, will be impacted through this program.

Research partnerships have been forged, and can be substantially expanded with organizations such as the Hampton Road Research Partnership, and the Hampton Roads Technology Council. These organizations help us to identify regional partners in industry and government for research partnerships and unique graduate training opportunities.

4) Threats:

A) State budget shortfall

The continued economic crisis across the country will have a negative impact on the College of Sciences in many ways. Over the last several years alone, COS has endured several significant budget reductions. These reductions have resulted in the loss of faculty and staff positions and the severe reduction of NPS funds in the departments. Faculty members are becoming frustrated because money for faculty raises was at first reduced and then eliminated. The budget shortfall also has a negative impact on graduate student support making it difficult to recruit the top graduate students. Additionally, staff members have greater work loads as empty positions are not filled.

B) Economic Uncertainty; erosion of endowments

The endowments that support research and activities in the college have been affected by the economic downturn. It is estimated that the endowment income may be reduced by up to 20% over the next several years.

C) Limited Instructional Classroom and Lab Space

The increase in freshman enrollments and the increase in majors have resulted in a demand for more seats in laboratory classes. Enrollment in these courses is limited by instructional laboratory space.

D) Increasing assessment burdens

The demand for assessment data has increased since the last strategic plan was formulated. As a requirement instituted by the State Council of Higher Education in Virginia (SCHEV), the College of Sciences was charged with developing, assessing and reporting on competencies in both scientific and quantitative reasoning. As part of the SACS accreditation process, the College must also provide assessment plans and provide

annual data through an online assessment tool. These assessment requirements were mandated without additional funding or personnel resources and in fact were established over a period of time when department and college budgets were substantially reduced.

E) Reduced institutional support for graduate students

Reduced support for graduate students (GTAs and GRAs) reduces our ability to attract the best graduate students, and that will have increasing impacts on faculty recruitment in years to come. If we strive to increase (or even maintain) the quality of our research and graduate programs, we must remain competitive in the amount of support supplied to our graduate students.

Goals and Objectives

Based on the above analyses, we have focused particularly on our strengths and opportunities to outline a plan for the future of the COS, 2009-2014

Goal 1: Increase research, scholarship and discovery in the College.

Objective A: Increase faculty publications in high impact journals.

Objective B: Increase the recognition of faculty as evidenced by number of awards, citations, invitations to chair scientific meetings, election to offices in selective societies and seats on review boards and panels.

Objective C: Increase the number of patents submitted by the College.

Objective D: Build on our established relationships with community research and high-tech industry organizations (HRRP; HRTC)

Goal 2: Continue to provide high quality educational opportunities to our undergraduate students by dedicated faculty.

Objective A: Decrease undergraduate students' time to graduation through careful advisement and mentoring.

Objective B: Increase the quality of incoming students through innovative recruitment activity and enhanced reputation.

Objective C: Track post graduate employment and education of our graduating seniors to determine their success post graduation.

Goal 3: Increase research support to $25 million per year in 5 years.

Objective A: Recruit faculty with reputations for high scholarship and research support that will transfer to Old Dominion.

Objective B: Provide conditions, such as teach loads, to ODU faculty to support scholarly research and the writing of research grants.

Objective C: Provide increased support of graduate students by research faculty through increased grant support and by competing for training grants.

Objective D: Increase submission of multi-investigator, multi-million dollar grants such as center grants, program project grants and training grants.

Goal 4: Increase the quality of the graduate programs.

Objective A: Increase the rankings of the program through strategic goals 1 and 3.

Objective B: Increase the quality of the admitted students.

Objective C: Ensure students complete their program on time.

Objective D: Establish a system to track students' post graduate employment.

Goal 5: Improve the academic performance of undergraduate students.

Objective A: Increase academic support services such as tutoring in STEM and other courses.

Objective B: Integrate faculty research with undergraduate education.

Objective C: Increase research opportunities for undergraduate students.

Objective D: Increase undergraduate student participation in regional, state and national scientific meetings.

Goal 6: Increase the impact of the College on the region.

Objective A: Provide employment both in and out of the region by obtaining federal grants.

Objective B: Provide a highly trained workforce for the industries and employers in the region through our educational programs.

Objective C: Provide educational opportunities to the populace within the region and the populace outside of the region through Distance Learning.

Goal 7: Increase the impact of the College with the military and federal agencies in the region.

Objective A: Increase cooperative partnerships with the Department of Energy through collaboration with Jefferson Lab and VCERC.

Objective B: Increase collaboration with NASA and NOAA.

Objective C: Provide educational opportunities for military personnel within the region and worldwide through Distance Learning.

Objective D: Provide educational seminars to military and federal agencies.

Goal 8: Increase diversity in the College.

Objective A: Increase recruitment of underrepresented minority students for graduate and undergraduate programs.

Objective B: Increase submission of grant proposals that address minority education in STEM disciplines.

Objective C: Actively recruit faculty from underrepresented minorities.