I. Definitions and Objectives

☐ Program meets education and experience requirements
  - Patient evaluation
  - Neurological examination
  - Natural history and pathophysiology of disease
  - Indications/contraindications to treatment
  - Clinical and technical aspects to treatment procedures
  - Medical and surgical alternatives
  - Pre-operative and post-operative patient management
  - Neurological Intensive care management
  - Fundamentals of imaging physics and radiation biology
  - Interpretation of radiographic imaging pertinent to practice

☐ NES training is full-time
☐ NES training is supervised

II. Duration of training

☐ Duration of training: minimum of 1 year for candidates with pre-requisites
☐ Duration of training extended for candidates with no prior NES experience

III. NES Program Director

☐ CAST NES Certified
☐ ABMS Certified: ABNS, ABPN, or ABR
☐ Concentrates 50% of time on NES
☐ Should have appointment in Neurosurgery
☐ Adequate support to fulfill training mission of fellowship
☐ Devotes adequate time to establish and maintain NES curriculum
☐ Appointed by and responsible to Chairperson or sponsoring Director

IV. Faculty Requirements

☐ At least one full time faculty certified by ABNS, ABPN, or ABR - OR - CAST NES Certification
☐ Direct didactic teaching and supervision of trainees
Promote scholarly activities and supervise research
Appointment in Neurosurgery Department or equivalent
Annual faculty evaluations documented

V. Faculty to resident ratio
Total number of trainees commensurate with program capacity to provide adequate training
Faculty-to-trainee ratio at least one faculty for every 2 trainees

VI. Educational program: Curriculum
Didactic and clinical experience encompasses full spectrum of NES

VI. Educational program: Preparatory Requirements
NES Fellows have completed ACGME-sponsored training program in Neurosurgery, Neurology, Radiology
Neurology-trained candidates demonstrate additional 1-year minimum, certification-eligible training in Stroke or Neurocritical care (ABPN, UCNS, or CAST)
Radiology-trained candidates demonstrate additional 1-year minimum, certification-eligible training in Neuroradiology (ABR Certificate of Added Qualification)
Basic course in Radiology skills and Radiation Protection
Preparatory training should include the following features
  - Use of angiographic needles, guidewires, catheters, devices, and materials
  - Radiology sciences including radiation physics, radiation protection, and pharmacology of radiographic and other imaging contrast materials
  - Angiography and imaging interpretation
  - Proper use and interpretation of laboratory tests
  - Evaluation of patients with neurological diseases
  - Clinical neurosciences including neuro-anatomy, neurobiology and pathophysiology
  - Clinical aspects of patient evaluation, treatment and management
  - Indications, limitations, and risks of NES procedures
■ Use and administration of pharmacological agents used in NES procedures

☐ Program Director documents completion of each component of preparatory training

VI. Educational program: NES Training

☐ 12 consecutive month period of dedicated NES experience

☐ Full spectrum of experience from patient assessment to long-term outcomes

☐ Anatomical and physiological basic knowledge
  ■ Vascular anatomy of brain, head and neck, spine, spinal cord: arterial and venous
  ■ Collateral circulations
  ■ Dangerous anastomoses
  ■ Cerebral blood flow and assessment
  ■ Vascular auto-regulation
  ■ Pharmacology of CNS vasculature

☐ Technical aspects of NES procedures
  ■ Catheter and delivery systems
  ■ Embolic agents
  ■ Flow-controlled embolization
  ■ Procedural complications
  ■ Electrophysiology
  ■ Provocative anesthetic testing procedures
  ■ Complications of embolization procedures and recognition
  ■ Imaging of the Vascular System

☐ Pharmacology
  ■ Contrast materials
  ■ Anesthetics used for provocative testing
  ■ Anti-coagulants and anti-thrombotic agents
  ■ Thrombolytic and fibrinolytic agents

☐ Coagulation cascade

☐ Diseases that result in ischemic and hemorrhagic stroke
NES Program Requirements

Check List

- Classification of stroke type
- Clinical Presentation
- Natural history
- Epidemiology
- Hemodynamics
- Indications for treatment procedures
- Contraindications to treatment
- Therapeutic modalities
- Combined therapeutic modalities

☐ Neoplastic diseases of head, neck, brain, spine and spinal cord
☐ Revascularization for occlusions
  - Arteriopathies
  - Atherosclerotic lesions
  - Techniques for revascularization including pharmacological and mechanical processes
☐ Epistaxis treatment and other causes for hemorrhage
☐ Invasive functional testing
☐ Balloon occlusion testing and analysis of data collected

VI. Educational Program: Conferences and Didactic Teaching

☐ Daily rounds with attending physicians during which evaluation and treatment decisions are made
☐ Conferences organized by faculty on broad range of NES topics, neurology, and neurosurgery
☐ Conferences include journal clubs, pathology conferences, interdepartmental meetings, and morbidity and mortality review (M&M)
☐ M&M conference with NES trainee participation at least monthly
☐ Participation in local and national extra-mural meetings
☐ At least one extra-mural national meeting or post-graduate NES course
VII. Patient Population

- Diverse patient population to permit full-range of NES training
- **Minimum of 100 therapeutic procedures per year**
- NES resident/fellow maintains procedure log
- Program Director maintains procedure log for entire program and individual trainees in CAST-approved format
- Procedure list must be presented in completed form at time of program review by ACGME RRC or CAST
- NES Fellowship must not have adverse effect on educational experience of ACGME residency programs

VIII. Equipment and Facilities

- Modern imaging/procedure rooms for use by NES fellowship program
- Physiological monitoring and anesthesia equipment in procedure rooms
- Additional state-of-the-art imaging equipment: MRI, CT, Ultrasound, Radiographic rooms
- Facilities to store implantable and disposable NES procedure equipment
- Appropriate in-patient, out-patient, emergency, and intensive care facilities for direct NES trainee involvement in clinical care and comprehensive NES care

IX. Scholarly Activity

- Graduate medical education in environment of inquiry and scholarship
- NES residents or fellows participate in research
- Faculty must demonstrate participation in scholarly activities
  - Faculty participate in clinical discussions, rounds, teaching conferences
  - Faculty participate in journal clubs and research conferences
  - Faculty participate in local, regional, and national scientific societies and meetings
  - Faculty and NES trainee participate in scholarly projects and research using peer-reviewed funding or result in peer-reviewed publications

X. Research
Investigational component with exposure to research including design, implementation, and interpretation of clinical and basic research studies

XI. Research Facilities
- Institution should provide laboratory facilities to support research projects relevant to endovascular therapies
- NES trainees encouraged to pursue research with residents and staff in other related specialties

XII. Interchange with Residents/fellows in other specialties and students
- NES trainees encouraged to attend and participate in clinical conferences
- NES trainees should participate in clinical teaching of neurosurgery and radiology residents, fellows and medical students

XIII. Duty hours and work conditions
- Duty hours and work conditions should match those for Program Requirements for Residency Education in Neurological Surgery

XIV. Evaluation: Residents/Fellows
- NES Program Director has clearly established defined procedures for regular evaluation of NES Resident/Fellow knowledge, skills, and overall performance
- NES Resident/Fellow must demonstrate development of professional attitudes consistent with being a physician
- NES Program Director and NES Faculty must complete the following components of the evaluation:
  - At least, semi-annual evaluation of knowledge, skills, and professional growth
  - Communicate each evaluation to NES Resident/Fellow in timely manner
  - Advance NES Resident/Fellow to positions of higher responsibility
  - Maintain permanent record of evaluation for each NES Resident/Fellow
  - Provide access to evaluation records to NES Resident/Fellow and other authorized personnel
■ Provide written final evaluation for each NES Resident/Fellow who completes the program
■ Final evaluation should include NES Program Director verification that the NES Resident/Fellow has demonstrated sufficient professional ability to practice competently and independently
■ The final NES Resident/Fellow evaluation should become part of the NES Resident/Fellow’s permanent record maintained by the Institution where the training occurred

XIV. Evaluation: Faculty

☐ NES Faculty must be evaluated at least annually to review teaching abilities, commitment to the educational program, clinical knowledge, and scholarly activities

XIV. Evaluation: Program

☐ Educational effectiveness of the NES Program must be evaluated in a systematic manner
☐ Quality of curriculum and extent to which the educational goals have been met by NES Resident/Fellows
☐ Requires assessment by NES Program Director
☐ Written evaluations by NES Residents/Fellows should be used and referenced in process