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This deals with the answers
& issues of the grant decrease
in cost estimates of Phase I.

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STRATEGIC DEFENSE INITIATIVE ORGANIZATION

DATE April 18, 1989

MEMO FOR Directors / RM

Attached for your information is a copy of the transcript from General Monahan's hearing before the HASC R&D Subcommittee.

Jeanine Ellars
Jeanine Ellars
Legislative Affairs

114473

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4 STRATEGIC DEFENSE INITIATIVE

5 ORGANIZATION RDT&E BUDGET REQUEST

6 FOR FISCAL YEAR 1990

7

8 Tuesday, March 14, 1989

9

10 House of Representatives,

11 Subcommittee on Research and

12 Development,

13 Committee on Armed Services,

14 Washington, D.C.

15

16 The subcommittee met, pursuant to call, at 10:05 a.m., in

17 Room 2337, Rayburn House Office Building, Hon. Ronald V.

18 Dellums, [chairman of the subcommittee] presiding.

INDEX

Populations Defense	31
Nuclear Energy (NDEW)	34
ABM Treaty	36
SBI Flight Test	42
BG Schnelzer	43
Funding	49
DSB	52
JCS Requirements	53
Soviet SDI	55
Airborne Laser	58
Dr. Mike Griffin	58
Technical Progress	61
Personnel	64
Cost Reduction	68
Abrahamson's End-of-Tour Report	71
BSTS/Compliance	74
BSTS/Cost	76
ASAT	81/88

19 Mr. DELLUMS. The Subcommittee on Research and Development
20 will come to order.

21 This morning, the Research and Development Subcommittee
22 will take testimony on the Strategic Defense Initiative
23 program. Our witness will be Lieutenant General George L.
24 Monahan, Jr., Director of the Strategic Defense Initiative
25 Organization.

26 General Monahan was confirmed to this position last fall
27 and officially became the Director in February, with the
28 retirement of General Abrahamson.

29 The Reagan budget request for the research and development
30 portion of SDI is about \$5.6 billion, representing almost a
31 \$2 billion increase over the authorized level of \$3.6
32 billion in fiscal year 1989. Between fiscal year 1985 and
33 fiscal year 1989, the administration has requested about 5.5
34 billion more than the Congress has appropriated for the
35 Strategic Defense Initiative. Each year, 1985 through 1989,
36 the Congress has reduced the request somewhere between 20-
37 and 30 percent.

38 General Monahan, I would think that given this past
39 history and the extreme pressures on the budget this year,
40 that chances of achieving this \$5.6 billion level for the
41 SDI program are extremely remote. Based on history, a level
42 closer to 3.5- to \$4 billion would represent a more
43 realistic estimate of the outcome, although I personally

44 believe that it should go even lower and focus solely on
45 basic research.

46 It would seem to the Chair that there must be, from even
47 the most ardent supporter of the efficacy of this program,
48 concern with respect to the administration's ability to
49 efficiently run a program that must be adjusted 20- to 30
50 percent downward each year over the requested level. I
51 would think that this would be an extremely inefficient
52 operation.

53 I know of no other defense program where the Congress has
54 consistently reduced a program and the administration has
55 continued to come in with over-optimistic funding requests
56 six or seven years in a row. I would hope that this new
57 administration could define a more clear set of objectives
58 for the SDI program and seek approval of these objectives
59 from Congress and debate on the merits or the lack thereof
60 so that a more stable funding profile can be established in
61 the out-years.

62 General Monahan, I appreciate the fact that you are just
63 now taking over this job and we do not have a confirmed
64 Secretary of Defense, but I would ask that you articulate as
65 best you can the objectives of the program and provide any
66 insights that you might have on the options that you are
67 looking at as President Bush works through his reduced
68 military budget.

69 Before you begin, I would like to recognize my
70 distinguished colleague, the gentleman from Alabama, Mr.
71 Dickinson, for such time as he may consume for any comments
72 he deems appropriate at this time.

73 Mr. DICKINSON. Thank you, Mr. Chairman, and thank you,
74 General Monahan, for your appearance here today. We welcome
75 you to your initial congressional appearance in your new
76 role as Director of SDIO.

77 It is my understanding that you are here today to discuss
78 SDI's current status, as well as President Reagan's 5.6
79 billion, which should make for a lively discussion. We all
80 understand the difficulty inherent in your current position
81 due to the leadership vacuum in the Pentagon and the general
82 lack of policy direction from the Executive Branch at this
83 point.

84 I gather that you do not intend to venture into the realm
85 of the SDI policy today, but such a decision is wise and--I
86 think such a decision would be wise for all program
87 managers. It is more important that a program manager view
88 his or her role, in my opinion, to answer the technical
89 questions such as can we, rather than should we. It would
90 be useful for the subcommittee if you would discuss briefly
91 what you perceive your role to be and providing your views
92 up front will hopefully allow the subcommittee to pursue
93 appropriate issues and to avoid turning this hearing into a

94 | protracted and inconclusive policy debate.

95 | To the extent you are able, the subcommittee would also be
96 | interested in hearing about any policy guidance that you
97 | might have received to date from the new administration, the
98 | Bush Administration. As my chairman alluded to, the Reagan
99 | budget, we feel, is not practical.

100 | We have seen this so successfully and we have seen the
101 | Congress year after year scale it back to what we felt--even
102 | though we are supporters of the program in general--we felt
103 | was a more doable and practical funding level.

104 | Finally, let me express one broad concern I have on this
105 | year's program. Last fall, a lot of political blood was
106 | shed in the battle to prevent certain factions in Congress
107 | from micromanaging the 4.1 billion that it authorized. One
108 | of the primary reasons that I urged the president to veto
109 | the defense budget was due to the fact that after we had
110 | dramatically reduced the funding for the SDI program, then
111 | some in the Congress wanted to go in and fence and
112 | micromanage the balance, or a big portion of the balance,
113 | absolutely denying the flexibility to the Director of going
114 | forward with the most promising programs and being able to
115 | delete those programs that didn't show as much promise.

116 | There was a lot of debate and a lot of concern over this.
117 | As a result of the veto, we were able to do away with most
118 | of the fencing. As a matter of fact, as it turned out, I

119 think the president came out looking pretty good in the
120 whole detail matter.

121 The centerpiece of the battle was the SBI, space-based
122 interceptor program, a program that certain members wanted
123 to cut by 25 percent and, as I said, micromanage the rest.
124 As part of the post-veto compromise, however, Secretary
125 Carlucci explicitly reassured Congress that no individual
126 SDI program would receive a budget reduction that was
127 disproportionate to the approximately 18 percent funding cut
128 that the overall program took. In our conference with the
129 Senate, Chairman Aspin and myself, Nunn and Warner, meeting
130 with Carlucci, wrestling with this problem--I think we had
131 two or three meetings on it--this is what we were told.

132 Despite the guarantee, though, the 1989 space-based
133 interceptor program was down-scoped dramatically. At some
134 point in the discussion here today, I would appreciate it if
135 you could explain how and why the SBI program was reduced,
136 and if you agree with that or if some effort will be made on
137 your part to remedy what was done.

138 We have a lot of ground to cover today, so I will take no
139 more time. I look forward to your testimony, General, and
140 again I would like to wish you well in your new endeavor and
141 welcome you here. I am sure we will be seeing a lot of you
142 in the weeks and days to come.

143 Thank you, Mr. Chairman.

144 Mr. DELLUMS. Thank you. The gentleman yields back his
145 time, and General Monahan, without objection, the full text
146 of your testimony will appear at the appropriate point in
147 the record and you may proceed in any fashion that you
148 choose.

149 STATEMENT OF LIEUTENANT GENERAL GEORGE L. MONAHAN, DIRECTOR,
150 STRATEGIC DEFENSE INITIATIVE ORGANIZATION

151

152 General MONAHAN. Thank you very much, Mr. Chairman. As
153 you just mentioned, I do have a statement to submit for the
154 record ^{that} and I propose ~~that~~ I submit ^{that} ~~that~~. ~~But, I would like~~
155 ~~today~~ first of all, ⁱⁿ in doing a presentation, I am going to
156 bring up the questions you just raised, so that we will get
157 to those, and I will make sure that we save time because
158 those are very important questions that both of you just
159 added on.

160 ~~What I would like to do, however--~~ ^{As} you know, we have a
161 strategic review under way in the Executive Branch at the
162 present time. That Executive review is looking at all of
163 our strategic programs, including the Strategic Defense
164 Initiative, and because of that, the program that is in the
165 president's budget at the present time is probably going to
166 be changed, and it may be changed substantially. I don't
167 really know how much and I don't know if our objectives will
168 be changed a lot, ^{Nevertheless,} ~~but nevertheless~~ I expect that when the
169 strategic review is completed and when a revised president's
170 budget ^{is submitted,} ~~should one be coming, should be submitted,~~ that the
171 Strategic Defense Initiative will be impacted, just as will
172 many, many other programs.

173 I think it is very useful that we understand that the

174 program does, indeed, have a baseline that was approved by
175 the Defense Acquisition Board last fall. That is the
176 program that is in the current president's budget. I
177 propose that I take you through some of that so that you can
178 understand that program, because ~~it is from there that~~
179 various options for proceeding in the future will logically
180 be derived *from there* (O)

181 That is why I have a handout that I believe all of you
182 should have ~~up there~~ and I would like to proceed and go
183 through that particular handout with you and just bring out
184 some of the high points that are involved.

185 On the second page, there is a listing of the SDIO
186 objectives. They have not changed, in the broad sense, over
187 a period of a few years. You ^{SDIO} note that it says to conduct a
188 vigorous research program, to develop the key technologies
189 against the ballistic missiles, and look at options for
190 deployment and to carry out a program in consultation with
191 our allies. I think working the program with our allies is
192 a major aspect of it that is very important.

193 On the third page, the current program structure is based
194 on the original SDI charter and it is worked against a
195 requirement from the Joint Chiefs of Staff. So, ~~it does, at~~
196 ~~the present time~~ the program that is in the president's
197 ^{at the present time} budget ^{is} backed up by a JCS requirement. The Defense
198 Acquisition Board met in October ^{of} 1988 and ~~had the~~

199 ~~program~~ approved the program proceeding into a
200 demonstration/validation phase for most of the elements that
201 are in the first phase.

202 We go to the next page, number 4. This describes the
203 program that is in the president's budget and was approved
204 by the DAB. You will note that on the right-hand side that
205 it is divided into two phases, a phase 1 and a phase 2. I
206 am going to concentrate mostly on phase 1 today.

207 Phase 1 is further divided into three major elements: the
208 sensors, the command and control and the initial
209 interceptors. Those will be kinetic kill type interceptors.

210 Note that the sensors would come first in the development
211 and, indeed, we are in the demonstration/validation phase of
212 the sensors at this time and one of the sensors, the boost
213 surveillance and tracking system, could enter full-scale
214 development as early as next year.

215 The command and control system comes a little bit after
216 that and finally the interceptors. Advanced weapons, then,
217 come in phase 2.

218 If we go to page 5, this just kind of encapsulates what I
219 said. Note that in the first phase of the program, it is
220 kind of a large green area there and that depicts a couple
221 of things. Number one, and in the first phase of the
222 program we will be building the basic infrastructure upon
223 which the subsequent phases would be built.

224 Secondly, the first phase of the program, you^{will} note, says
225 kinetic energy interceptors. So the first phase would
226 concentrate on those. Those are interceptors that destroy
227 ballistic missiles or reentry vehicles simply by collision.
228 No explosive charge or munition of any sort.

229 We get into subsequent phases, phase 2 and phase 3, then
230 we get into the directed-energy weapons, such as lasers,
231 either ground-based or space-based or neutral particle beam
232 weapons.

233 On page 6 is, ~~first of all, a history of~~ as the chairman
234 pointed out^a ~~the~~ history of the funding versus the
235 president's budget request in the past. I just want to make
236 one point here. If I take the 3.7 billion that was
237 appropriated for fiscal year 1989, then in order to pursue
238 the program that I am going to describe to you, which, as I
239 said, will probably be altered in the strategic review, then
240 the funding there, 5.6 in 1990 and 6.7 in 1991 would be
241 required to pursue this particular program.

242 Go to page 7. I would begin to describe the phase 1
243 system and the job that it is to do. First of all, go from
244 right to left on the chart. It is useful to describe the
245 path that a ballistic missile takes in the various phases of
246 its flight. First is the boost phase. I think that is self-
247 explanatory.

248 Then in the post-boost phase, the boosters have dropped

249 away from the missile and the reentry vehicles that are on
250 what we call the bus, on the top of the missile, then start
251 to deploy. When you get to the mid-course phase, then all
252 the reentry vehicles and any decoys are flying on their own.
253 They are now deployed from the bus and finally, when you
254 get into the terminal phase, they are reentering the
255 atmosphere.

256 As I describe the program, I am going to first ~~of all~~
257 describe sensor elements ~~and the sensor elements~~--we will
258 again start from right to left on the chart ~~I will~~
259 ~~describe the sensors~~ that look for the initial boost phase
260 and then sensors that finally look to the terminal phase.
261 Then I will talk about interceptors, space-based
262 interceptors, which would have the objective of intercepting
263 boosters in the booster/post-boost phase and finally reentry
264 vehicles by ground-based interceptors in the mid-course
265 phase or terminal.

266 The next page--and I have just made a separate sheet to
267 hand out because we can get wrapped in alphabet soup in this
268 program very quickly. This is just--and you might just want
269 to keep that handy, because it describes what these
270 abbreviations are for that I will be--what the abbreviations
271 mean, the abbreviations I will be using throughout the
272 presentation.

273 The first sensor, if I go to page 9, is what we call the

274 BSTS, the boost surveillance and tracking system. Its job
275 is to look at the entire globe from a very, very high orbit,
276 geosynchronous orbit, and it does, in that sense, the same
277 thing that current satellites do today, and it can detect,
278 among other things, ballistic missile launches. ~~You can see~~
279 I could detect ICBMs, IRBMs, SLBMs. It will acquire
280 missiles that have been launched, start to track them,
281 determine what type they are and try to give us an
282 assessment of whether or not we are able to destroy them,
283 and then it plays a big role in communications and battle
284 management.

285 On the next page, 10, you will see an artist's conception
286 of two of the concepts that are possible for BSTS. We have
287 two contractors at the present time and they are in a
288 demonstration/validation phase with these two types of
289 satellites, but it is also possible for other contractors,
290 when we go into full-scale development, to enter the
291 competition, should they have other satellites that would
292 meet our requirements.

293 The 11th page, then, is a depiction of the coverage that a
294 BSTS has, and I tried to draw this particular chart to scale
295 as far as the earth and where the orbit is with the
296 geosynchronous orbit 22,000 miles above the earth, and note
297 that we would envision a system of probably six satellites.
298 That gives us good overlapping coverage of all areas of the

299 | earth at all times.

300 | So that is the first sensor and that is the sensor that
301 | would detect the initial launch of a ballistic missile, from
302 | wherever it occurred on the earth.

303 | The next sensor is the space surveillance and tracking
304 | system. Besides being able to track ballistic missile
305 | boosters, it also has the capability to track reentry
306 | vehicles or at least clusters of reentry vehicles and the
307 | post-boost vehicle. The post-boost vehicle is the vehicle
308 | on which the reentry vehicles are mounted and it is from the
309 | post-boost vehicle that they are deployed.

310 | It would act as a fire-control sensor for space-based
311 | interceptors. It would be able to at least see clusters of
312 | reentry vehicles and decoys and could hand those off to the
313 | ground surveillance systems and the ground-based radar.

314 | On page 13 is an artist's conception of what a space
315 | surveillance and tracking ^(SST's) system satellite would look like.

316 |

317 | Page 14 is, I think, a little bit more interesting because
318 | it shows the ~~it shows~~ the coverage of these ^TSSBS. Note,
319 | they have kind of a donut shape coverage and because they
320 | don't have to look at the earth--and we very purposely do not
321 | have them staring at the earth, but rather out into space,
322 | that way they don't have to worry about the clutter that
323 | comes from the earth background and are able to see much,

324 much smaller objects than that boost surveillance and
325 tracking system was able to.

326 Then the third sensor in the system, as we now get down to
327 finer and finer grain of tracking, is the ground-based
328 surveillance and tracking system^(SSTS) which is there to
329 discriminate reentry vehicles from decoys or other
330 penetration aids. It also is a backup to the SSTS should
331 the SSTS be attrited or somehow or another compromised and
332 also the capability to track objects at lower altitudes.

333 An artist's depiction on page number 16, and the one thing
334 that may or not be evident from this, but this is a
335 suborbital device; i.e., it does not go into orbit. It is
336 launched from the ground as we get a warning from the BSTS
337 or the SSTS that there is a raid incoming and it is
338 launched.

339 Now, on the next page, number 17, you will see the
340 potential coverage where those may be launched from, but it
341 has a lifetime of maybe 15 or 17 minutes, something of that
342 sort, but in that period of time, is able to discriminate
343 between reentry vehicles and possible decoys and pass that
344 information down through the command and control system.

345 Finally, the most fine-grained element of the system, on
346 page number 18 is a ground-based radar ~~and here~~ this is the
347 first time that radar comes into play among these sensors.
348 The previous sensors I described all were infrared type

349 sensors. Now we are using a radar so that the
350 characteristic radar of being able to do some very fine-
351 grained observation for us can now come into play.

352 Here is an artist's conception on page 19 of either
353 perhaps a mobile version of a ground-based radar or one that
354 is stationary. There are various concepts we have under
355 consideration at the time. This is one of the sensor
356 elements that has not yet entered into the
357 demonstration/validation phase, but it will very, very
358 shortly. The other elements I just described were all in
359 the demonstration/validation phase.

360 Finally, those are the sensors now that I have described.
361 I described them from ~~the most~~ those that take the ^{broadest} ~~grossest~~
362 look, able to just detect boosters, to those that can detect
363 and discriminate reentry vehicles. To tie it all together,
364 we need a command and control system. On page number 20, I
365 begin to talk about that.

366 Note the first bullet on there. Through any scheme that I
367 have ever heard of for ^{the} Strategic Defense Initiative, man is
368 in control. Man is in the loop in controlling these various
369 elements of the system, so the decision authority rests
370 there. There is no such thing as an automatic initiate or
371 anything of that sort.

372 We would plan--and our thinking is not all that well
373 defined at the present time--but we would plan on fixed

374 command centers within. For reasons of survivability, I
375 think we clearly have to have mobile command centers also.
376 The command and control system for SDI promises to be very
377 complex. I don't see anything that is really undoable about
378 it. It will be a complex system to engineer.

379 On the next page, 21, is a picture of what we call EV-88,
380 an early version. That is a picture from down at
381 Huntsville, Alabama, where the Army's Advanced Research
382 Center has been doing some advanced simulation work for us
383 and are fairly well along on coming up with concepts that
384 will work well in the command and control.

385 So, now, getting to page 22, I have described the sensors;
386 I have described the command and control system; now let's
387 look at the interceptors themselves, the kill vehicles
388 themselves.

389 By the way, what I just showed you in the way of the
390 sensors ~~those~~ may or may not be treaty-compliant. In other
391 words, what I have just described, in a command and control
392 system, there is still--some of those have the possibility of
393 ~~being treaty compliant~~ because ~~For example, the GSTS/~~ has a role that is ~~very--that~~
394 ~~is~~ not only SDI, but also has the role of replacing the DSP
395 satellites we have today, and a space surveillance and
396 tracking system also has the role of looking for ASATs and
397 tracking lots of objects in space, which is becoming more
398 and more important to us.

399 So deployment of those sensors may be treaty-compliant.
400 We don't know yet and our treaty-compliance people are
401 looking at them.

402 Now what I am about to describe to you in the
403 interceptors--these clearly are not treaty-compliant when you
404 get to the deployment phase. You can make some arguments
405 perhaps about testing of them, but when you get to
406 deployment, then the interceptors I am going to talk about
407 now would not be treaty-compliant, which says we really need
408 to start to work on just what we are going to do about the
409 ABM Treaty.

410 Let me, though, describe the ground-based interceptor and
411 then, secondly, the space-based interceptor. The ground-
412 based, ^{interceptor will be} fairly light weight, hopefully very, very low cost.
413 They would be deployed in some fashion not all that
414 different from anti-aircraft, surface-to-air missiles, and
415 using the sensors I have just described, would be launched
416 to make a kinetic kill. ^{Again} and kinetic is important. In
417 other words, there is no explosive charge of any sort. They
418 simply collide with the reentry vehicles, either in the
419 terminal phase or in the mid-course phase.

420 Here is the experiment version--one we call the ^{EPIC} ~~EROS~~, on
421 page number 23, and it utilizes in the experimental version,
422 the second and third stage of Minuteman missiles--we make
423 some economies there and then you see blown up what the

424 guidance and the kinetic kill section of the vehicle looks
425 like.

426 The next is the space-based interceptor^(SBI) and I think that
427 is just very descriptive, the words themselves. It is based
428 in space. These are indeed satellites and, again, use the
429 kinetic kill type mechanism. There is no explosion of any
430 sort involved with them.

431 On page number 25, you will see the depiction of what the
432 coverage of these would be as they are in orbit. You see
433 the many, many dots on here. Each one of those dots is
434 meant to represent a carrier vehicle. At the time of the
435 DAB, back in October, the carrier vehicle was envisioned to
436 include 10 space-based interceptors. We are looking at
437 different concepts today, but nevertheless, the principle is
438 still the same. Those space-based interceptors would be in
439 these various orbits around the earth, constantly moving,
440 and obviously, there is the capability there to defend not
441 only the United States, but to shoot down ballistic missiles
442 in their boost phase or post-boost phase no matter where
443 they are launched from and no matter where they are going.

444 So, space-based interceptor carries that kind of advantage.

445 It also has the big advantage of being able to hit a
446 missile in its boost phase when it still has all the reentry
447 vehicles on it. You know, the Soviet SS-18 carries--I don't
448 know if this number is classified, so I won't say it, but

449 the SS-18 carries quite a few reentry vehicles. So, the
450 with the space-based interceptor, if you can get one missile, you can
451 kill quite a few reentry vehicles right there.

452 When you get to the ground-based system, the ground-based
453 system, then, has to take on each reentry vehicle as it
454 enters the atmosphere.

455 Mr. DICKINSON. General, the SS-18, if the number of
456 reentry vehicles is classified, who are we keeping it secret
457 from?

458 General MONAHAN. That is a good question, Mr. Dickinson.
459 I can talk to you later about why I said that, but--

460 Mr. DICKINSON. Go ahead.

461 General MONAHAN. Does anybody know the answer? It is not
462 10. It is not classified, it is 10.

463 Mr. DICKINSON. Hell, I knew it was 10. Everybody knows
464 it is 10.

465 General MONAHAN. I know.

466 If I may, then, review the program here on page number 26.

467 You will note that we tried to lay out when the DEMVAL, the
468 full-scale development and production phases of the program,
469 would occur. Note that the BSTS program, boost surveillance
470 and tracking system, would begin full-scale development
471 earlier than the others and could begin as early as fiscal
472 year 1990.

473 For the remainder of the systems, we are talking about

474 getting into about fiscal year 1992 or 1993 before that
475 occurs.

476 Page number 27 is the depiction of the costs as they were
477 presented at the Defense Acquisition Board last fall and you
478 can notice that they went up, ^{and then} they came back down, as some
479 major changes were made in the program and the current
480 estimate to proceed with the program, as I just described
481 it, is \$69.1 billion, and hopefully, being able to reduce
482 that.

483 If I may, then, go to the next chart, number 28, and this
484 is perhaps one of the major potential areas for cost
485 reduction, and that is with the Brilliant Pebbles concept.
486 When I described the space-based interceptors a minute ago,
487 I said that they were housed in vehicles that carried 10
488 apiece. That number is not classified. In the Brilliant
489 Pebbles concept, we would deploy them in singlets. In other
490 words, each missile all by itself. The missile would be--the
491 interceptor would be relatively small, only about a foot
492 long--excuse me, about a yard long, about a meter long,
493 probably weigh about 100 pounds or less, would have some
494 highly dense packaging of the sensors and propulsion system
495 and all that is necessary for it to do its job.

496 It also differs from our current space-based interceptor
497 concept in that in at least one mode of operation, the
498 Brilliant Pebbles is envisioned to be able to operate

499 autonomously. In other words, it doesn't have to get hand-
500 offs or information from other sensors.

501 The sensors on the Brilliant Pebbles would have the
502 capability of detecting launches of boosters and then have
503 additional sensors that could guide it to the target should
504 it be enabled by a decision made by man on the ground to let
505 it fly free, to go destroy a target.

506 So it has an awful lot of ~~potential, I think, for and it~~
507 ~~has a lot of operational potential, I think it has a lot of~~
508 potential to reduce costs.

509 At the same time, there is an awful lot that is still
510 unknown about Brilliant Pebbles, and there is a lot of
511 technical work, a lot of research work left to be done. For
512 example, could the several small sensors onboard the
513 singlet--onboard the Brilliant Pebbles indeed be able to
514 detect what we think it has to detect? Could we, indeed,
515 package the electronics into the small space required? We
516 have never mass-produced anything like this before; there
517 has never been mass production of satellites and these
518 Brilliant Pebbles would be both satellites and they are also
519 something like air-to-air missiles. They are kind of a
520 cross between the two. So that makes it difficult to get a
521 handle, without ever having to try to mass-produce them
522 before, ~~it tries to get a difficult~~ it makes it difficult to
523 try to get a good handle on costing them just at this time.

524 ~~But nevertheless~~ Oh, yes, and then there is the
525 communication system that would be required. We would
526 envision deploying these in the thousands, many thousands,
527 and they would have to be hooked together by a very robust
528 communication system.

529 All ~~of that that~~ I have just described is, I think,
530 doable. I think there is a lot of potential there, but ~~I~~
531 ~~think that we have to~~ the degree to which you could be
532 successful in a timeframe in which you could be successful
533 and how much it would ultimately cost, I think are all
534 unknowns at this time.

535 So we are, in our options, looking at--as part of the
536 president's strategic review, we are looking at options that
537 do include robust work as far as Brilliant Pebbles is
538 concerned.

539 As I said, to wrap it all up, I think there is a lot of
540 potential here with the Brilliant Pebbles program.

541 Page 29 is just a look, an artist's--no, this is an actual
542 picture of a test vehicle we have there.

543 Now, from the test of this, I have just described the
544 phase 1 system and described the Brilliant Pebbles. For
545 now, let's start talking about things that would come later,
546 things that will come in phase 2 and beyond.

547 Again, here is a list of the abbreviations. The HEDI, the
548 space-based laser, neutral particle beam, ground-based

549 laser, et cetera. The first of those is the HEDI, or the
550 high endoatmospheric defense interceptor. Here, we would
551 have a vehicle that is able to intercept the reentry
552 vehicles while they are in the terminal phase.

553 On page number 32, there is a picture of a test vehicle
554 that we are going to launch this summer.

555 Space-based laser. I think the description--the words
556 speak for themselves. Obviously, you hit something with the
557 speed of light. Note, however, it is a very, very, very
558 large satellite. We think about 220,000 pounds. There is
559 an artist's depiction of such a satellite on the next page.

560 The next is the neutral particle beam device which could
561 be deployed in space. I am on page 35 now.

562 Mr. DICKINSON. General, is the shuttle--what is capable of
563 putting 220,000 pounds in orbit? Do we have anything--

564 General MONAHAN. I don't know. I get worried again about
565 classification. I don't know at the present time, Mr.
566 Dickinson, of a vehicle that we have than can do that.

567 Mr. DICKINSON. I didn't think so. Is that what we call
568 pie in the sky?

569 General MONAHAN. No, sir. You have perhaps heard of the
570 advanced launch system program, and when you get to space-
571 based lasers or space-based neutral particle beam weapons,
572 then you ~~probably--then you~~ do need something that an
573 advanced launch system could offer. Up until that time, you

574 probably don't need an advanced launch system.

575 The neutral particle beam weapon, which destroys simply by
576 shooting hydrogen atoms, is another concept and you can see
577 it it would be a satellite of substantial size, about
578 116,000 pounds. That, again, is something for the phase 2
579 or phase 3 program and it is quite a ways out in the future,
580 although some very, very good progress has been made
581 technically in pursuit of this.

582 Page number 37, I talk about a ground-based laser.
583 Obviously, it can do the same thing as a space-based laser,
584 but on page 38, you note that we have to use relay mirrors
585 in order for it to do its job. So whereas you could keep
586 the laser on the ground, such that it would have access to a
587 very, very large power supply--that is the big advantage of
588 keeping it on the ground--you still have to put satellites in
589 orbit that would have the mirrors on them.

590 *In reviewing the*
590 ^ ~~The~~ next couple charts, beginning with number 39, I would
591 like to talk just a little bit about what technology has
592 done in the program. You note there has been about \$15
593 billion invested in the program to date, a lot of technical
594 work under way, and these are just a few examples of some
595 things that have come out.

596 On page 39, you will note an inertial measurement unit--or
597 inertial navigation sat. From the 1970s, it cost about
598 \$70,000 and weighs 41 pounds, and you note that under SDI,

599 they have developed that now down to the point where it just
600 weighs about eight ounces. It is about this big and costs
601 only about \$8000 and has no moving parts. That is just one
602 example.

603 Another example on page number 40 of what has been done in
604 the way of divert motors. You note the one over there on
605 the left which is of the vintage of the 1960s and coming all
606 the way over to the right, which has been developed now
607 by--through the SDI program. A great reduction in weight, a
608 great increase in thruster weight and a great reduction in
609 cost per unit.

610 RPTS TETER

611 DCMN TETER

612 On page number 41, it shows the same sort of things in
613 computers, and indeed, the generic computer that we would
614 use on various ~~of those~~ sensor platforms that I mentioned is
615 depicted over on the right and you can see the tremendous
616 decrease in size, but the great increase in through-put
617 capacity. Fifteen million instructions per second versus
618 just 3 million instructions per second from older hardware
619 that is much bigger. So that has been developed.

620 On page number 42, those of you that are familiar with the
621 Maverick missile--here is the device that I don't try to
622 claim can do the same thing that a Maverick can, but the
623 electronics unit inside of the Maverick weighs about 100
624 pounds and the electronics unit developed here for the leap
625 projectile just weighs half a pound and occupies much less
626 volume.

627 Those are just a few of the examples of the technology
628 that benefits--not only direct benefit to the SDI program,
629 but is going to benefit many other areas as well.

630 Just a quick look, beginning on page 43, as to how the
631 budget is broken up ~~First of all,~~ by who manages^{it}--obviously
632 SDIO manages all of it. We use the Air Force and the Army,
633 DARPA, the Department of Energy, DNA, the Navy, also as
634 agents. That first chart just shows how that is broken up.

635 I then get into the program elements, however, on page
636 number 44. That gives all the information as to how it is
637 divided before the major elements of directed energy
638 weapons, kinetic energy weapons, SATKA, et cetera.

639 One that is perhaps more important, though, is on page
640 number 45. On page number 45, for 1990 and 1991, it shows
641 how much of the budgets are planned to go towards the phase
642 1 system, the follow-on systems and the technology. Note
643 about 45 percent or 46 percent is technology and about
644 another 40 percent is in the systems area of phase 1 and
645 phase 2 systems.

646 With that, just a couple of words of summary, Mr.
647 Chairman. There has been substantial investment in the
648 program, a lot of technology advance^{ments have} has been made and the
649 current budget, as it was put in, maintains a balanced
650 program and then pursues the phase 1 effort that I talked
651 about throughout this presentation.

652 With that, Mr. Chairman, I would like to make some
653 comments about some of the questions that were asked here
654 just a little bit earlier by yourself and by Mr. Dickinson.

655 First of all, Mr. Dickinson asked about what is my view of
656 the role of the program manager and I agree with him, the
657 program manager, the role that I have, should be that of the
658 person that ^{asks} ~~says~~ what can we do, rather than what should we
659 do? In other words, I think that I should be required to

660 give you as objective an assessment as I can of things
661 ^{such as} ~~that~~--technical risk, technical difficulty, cost assessment,
662 schedule assessment, ^{I should} be able to tell you what we can do and
663 the should do, I think, requires a much, much bigger forum
664 and a much broader forum.

665 That is what is encouraging about the strategic review
666 that is under way at the present time, because we now have
667 the defense and the offense being considered together in
668 that strategic review. I think that is providing that kind
669 of forum.

670 For that part, our ^{organization} is making a lot of input
671 on various options as far as the strategic review is
672 concerned. We are telling people, just as I said, how tough
673 is it to do technically? Is it possible to do it
674 technically? How much does it cost? How long does it take,
675 and answering those kinds of questions.

676 I think Mr. Dickinson also asked about my view on fencing.
677 No program manager that I have ever known ever likes to see
678 his funds fenced. Why? It is very simple. It just takes
679 away flexibility that he has in pursuit of the program.
680 Now, the flexibility he has to have when a program is way
681 downstream in production is nowhere near the kind of
682 flexibility he has to have when a program is way up front in
683 research, in the research and development phase. That is
684 exactly where we are at the present time.

685 We have not entered full-scale development of any element
686 of SDI. Rather, we are still in the
687 demonstration/validation phase and in that phase, you have
688 to make lots of tradeoffs, first of all, between--you know,
689 should I have the SSTS do this or the BSTS do this or is it
690 better to have that done on the ground or in space? You
691 have to make those kinds of tradeoffs as specifications
692 start to get tightened up.

693 So it is very important at this stage of the game, it
694 seems to me, if we put together a balanced program that we
695 avoid fencing, if at all possible.

696 Let's see--oh, you asked, Mr. Dickinson, also, about the
697 SBI. It was down-scoped, and that happened because ~~of~~
698 ~~the~~ when the fencing initially occurred and was in the
699 proposed legislation, the SDI ~~Organization~~ took it on itself
700 to reduce that because it looked like they wouldn't be able
701 to spend it anyhow. As a result, I guess some people got
702 laid off and some bad things happened there. It never get
703 restored as back as far as we want it.

704 Mr. Chairman, ^{according to} ~~that~~ ^{the SDI} ~~from~~ my notes, I think ~~those are~~ the
705 questions that you asked very specifically ^{about} and I will
706 be happy to take any other questions you may have.

707 [The statement of General Monahan follows:]

708

709 ***** INSERT 2-1 *****



STATEMENT ON

THE STRATEGIC DEFENSE INITIATIVE

BY

LIEUTENANT GENERAL GEORGE L. MONAHAN

DIRECTOR

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

BEFORE THE

SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT

COMMITTEE ON ARMED SERVICES

HOUSE OF REPRESENTATIVES

101st CONGRESS, FIRST SESSION

MARCH 14, 1989

Thank you for the opportunity to appear before this Subcommittee today to testify in support of the SDI budget request.

As you are aware, the top-level strategic review and revisions to the President's budget may result in an adjustment to the budget request for SDI and other programs. At present, however, the objectives of the research remain constant and are shown below:

Figure 1. SDI Objectives



SDIO OBJECTIVES

- Conduct Vigorous Research Program To Develop Key Technologies For Defense Against Ballistic Missiles
- Consider Options To Increase The Contribution Of Defenses To US And Allied Security
- Protect Options For Near-Term Deployment Of Limited Ballistic Missile Defense
- Carry Out Program In Full Consultation And, Where Appropriate, With Participation Of Our Allies

The SDI budget request is \$5.6 billion and \$6.7 billion for fiscal years 1990 and 1991, respectively. The following charts provide details.

Figure 2. FY 1990-91 Budget Compared To Past Appropriations

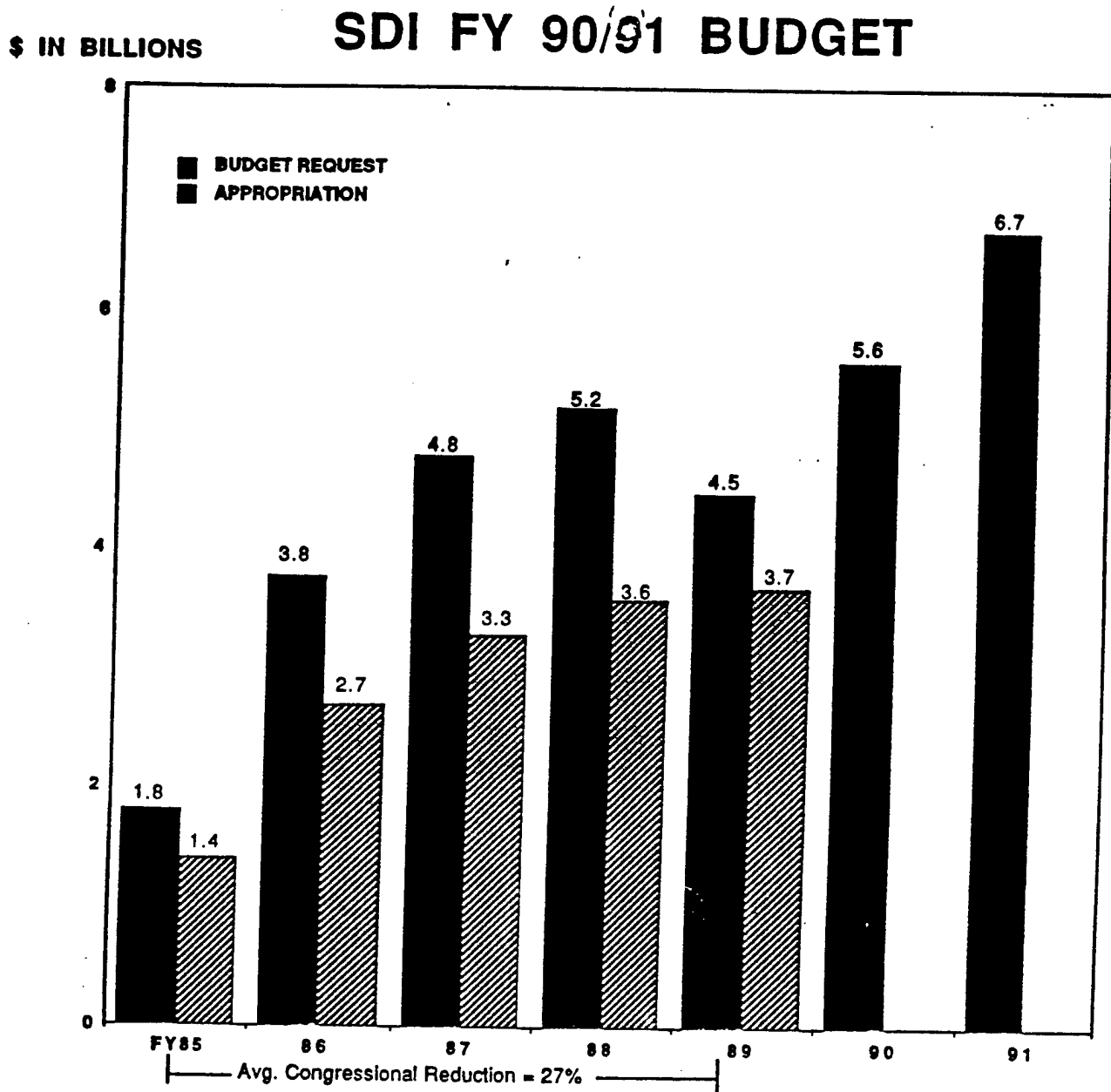


Figure 3. SDIO RDTE Funds by Program (\$ million)

	FY86	FY87	FY88	FY89	FY90	FY91
Sensors	844	923	935	1101	1281	1436
Directed Energy	796	853	934	820	1117	1323
Kinetic Energy	596	723	773	773	1346	1534
Systems Analysis/ Battle Mgmt	212	386	461	506	781	976
Survivability, lethality, and Key Technology	214	375	430	406	777	948
Boost Surveillance and Tracking System - Full Scale Development					262	427
HO MGT	13	20	20	21	26	27
Total	2675	3280	3553	3627	5590	6671

Figure 4. SDIO Budget Request Compared To Other Accounts

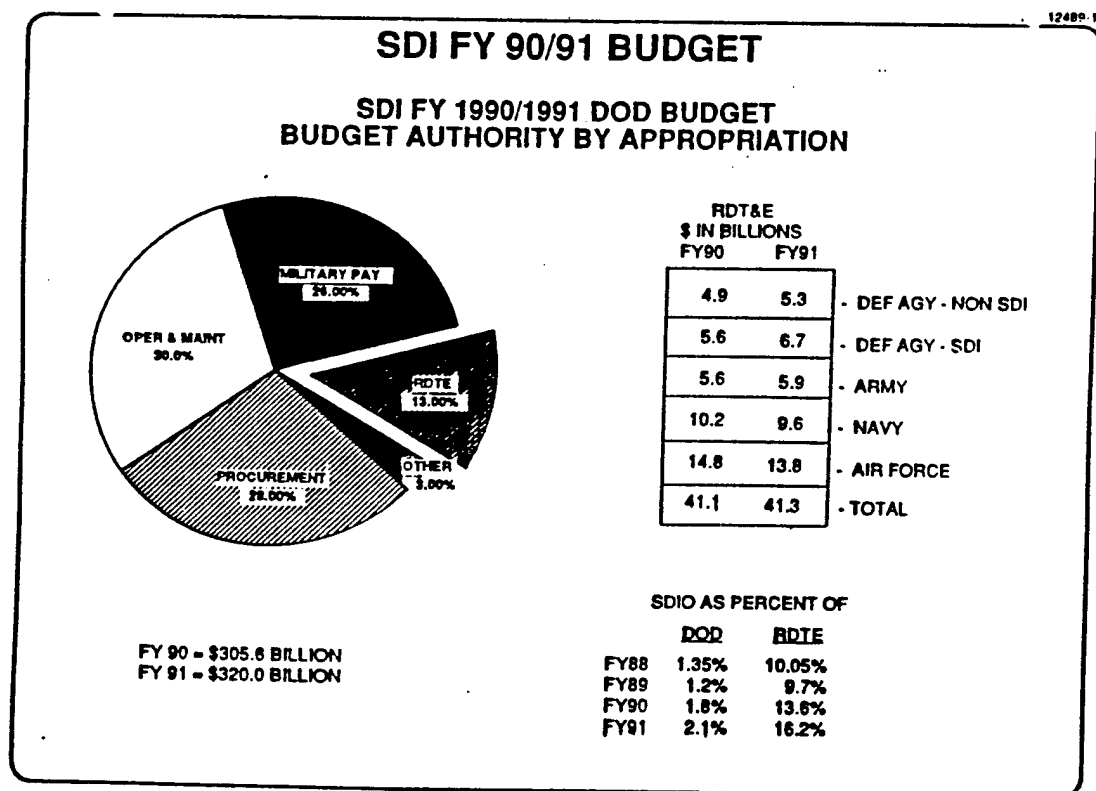


Figure 5. Distribution of SDIO Funds by Project

PS #	PROJECT #	TITLE	FY88 \$ Actual	FY88 \$ APPN	FY89 \$ Request	FY91 \$ Request
0803220C		Surveillance, Acquisition, Tracking, and Kill Assessment Projects				
	01	Radar Discrimination and Data Coll	16,267	21,175	28,995	28,952
	02	Optical Discrimination and Data	99,078	110,984	123,822	163,747
	03	Monomove Radar Tech	17,288	14,323	28,986	28,983
	04	Laser Radar Tech	79,890	80,771	98,862	101,899
	05	Passive Sensor Tech	85,841	71,288	98,864	108,842
	06	Signal Processing Tech	88,122	81,943	100,848	108,827
	07	Intensive Data Tech	23,141	13,980	37,841	41,932
	08	Boost Dem/Vol	173,993	236,000	67,511	0.000
	09	Midcourse Dem/Vol	37,746	107,966	163,784	314,816
	10	Midcourse Experiment	99,701	98,891	42,930	28,983
	11	Terminal Dem/Vol	38,982	72,383	144,475	180,343
	12	SATKA Support	117,216	122,980	217,548	214,114
	81	IS&T	98,374	43,288	98,005	114,886
	82	Delta Star	7,900	0.000	0.000	0.000
	83	Support Programs	48,510	31,881	32,982	36,018
		TOTAL SATKA	984,808	1100,725	1281,023	1438,000
0803221C		Directed Energy Projects				
	20	PEL	172,086	302,322	278,082	302,010
	21	ATP	282,348	183,881	254,817	244,610
	22	CL	100,080	100,138	348,486	511,190
	23	NPS	108,018	98,988	114,829	114,786
	24	MIRACL/T	27,800	4,000	0.000	0.000
	25	CDT/Emerging Tech	167,142	96,183	64,729	82,482
	81	IS&T	19,315	15,000	34,130	40,985
	82	Delta Star	66,218	72,982	0.000	0.000
	83	Support Programs	21,610	48,884	27,009	17,274
		TOTAL DEW	934,286	819,759	1116,922	1322,877
0803222C		KineGe Energy Projects				
	30	Space Systems	185,000	132,000	348,286	380,412
	31	Exo KKV Systems	116,000	202,255	244,225	293,819
	32	Endo KKV Systems	106,250	145,875	218,564	191,488
	33	Advanced Tech Weapons	117,582	89,105	217,873	311,307
	34	Test and Evaluation	123,105	88,015	107,137	148,885
	35	Technology Support	6,658	9,405	9,886	9,545
	42	Threater Defense	67,958	75,787	138,280	148,957
	81	IS&T	23,565	21,702	41,277	49,190
	82	Delta Star	6,147	0.000	0.000	0.000
	83	Support Programs	32,102	28,967	22,467	22,974
		TOTAL KEW	773,167	773,111	1346,514	1634,557
0803223C		Systems Analysis and Battle Management Projects				
	40	SDS Engineering and Support	72,590	82,086	131,407	201,071
	42	Threater Defense	90,500	30,805	48,922	46,720
	43	CC/SOIF Technology	64,206	58,572	86,368	107,817
	44	CC/SOIF Experimental Systems	91,073	74,179	143,778	203,071
	45	National Test Bed	77,713	100,179	115,827	121,802
	46	SDS Phase I Engineering	45,201	63,470	125,210	155,531
	47	Test & Evaluation	8,961	8,477	9,985	14,977
	81	IS&T	12,985	16,350	25,832	30,802
	83	Support Programs	22,962	53,289	70,868	70,871
		Technology Applications	18,488	20,277	22,987	22,985
		TOTAL SA/BM	481,459	506,476	780,854	975,827
0803224C		Survivability, Lethality, and Key Technology Projects				
	50	Systems Survivability	91,305	102,991	189,450	218,114
	51	Lethality and Target Hardening	68,641	62,218	124,434	152,128
	52	Power and Power Conditioning	97,204	99,509	205,295	236,979
	53	Space Transportation and Support	79,558	85,000	124,809	154,750
	54	Materials and Structures	24,990	30,731	68,428	86,061
	55	Countermeasures	21,245	22,270	34,984	42,356
	81	IS&T	23,800	19,376	40,905	48,610
	83	Support Programs	23,131	15,248	8,472	8,578
		TOTAL SLKT	429,574	406,343	776,787	947,576
0804220C	80	BST3 PSD	0.000	0.000	262,000	427,000
0805898C	83	Management Headquarters	20,026	21,000	26,394	27,454

The classified FY 1990 Report to Congress on the SDI Program was submitted to the Congress on January 19, 1989. The unclassified version of that report should be available soon. This report describes in detail the content of the total SDI research program. With your indulgence, I would like to take a few minutes to highlight some very important points from the report. First, the SDI research program seeks both mature and emerging defense options. For example, kinetic energy systems (e.g., rocket-propelled interceptors) -- which will be deployed in the initial phase of a defensive system -- and directed energy weapons (lasers, particle beams) are being researched with equal dedication. Second, the emerging defense options are integral to the program's success in countering potential Soviet responses to a deployed Strategic Defense System (SDS).

In October, 1988, the Defense Acquisition Board (DAB) completed an annual progress review of the technologies previously selected for the demonstration and validation phase of the Defense Acquisition Process. These technologies, constituting Phase I of the Strategic Defense System (SDS), are ground- and space-based sensor systems, ground- and space-based ballistic missile interceptors, and Battle Management, Command, Control and Communications.

Prior to development and deployment, any SDS must demonstrate an ability to meet the requirements of military effectiveness, survivability, and cost effectiveness. The focus of the research into SDS/Phase I elements is to develop Phase I technologies which can meet these requirements. We are encouraged by our progress.

Cost reduction has long been recognized as an important component of the SDI program, and cost-reduction efforts have been emphasized in tandem with technology research. By anticipating potential SDS costs, and by implementing technology development strategies that focus on reducing costs, we believe the SDS will be affordable. As Lieutenant General Abrahamson testified last October to the joint committees on Armed Services, the current estimate of the total cost to demonstrate, validate, develop and deploy the first phase of a SDS is \$69 billion. This figure is a substantial cost reduction from earlier estimates, and we expect even further reductions as architecture refinements, new manufacturing techniques and other improvements are made. The reduction to \$69 billion was achieved largely through eliminating unnecessary redundancy, increased space-based interceptor performance (resulting in the need for fewer interceptors), and from more capable sensor technology and design. We will continue efforts to both develop systems which are cost effective and seek trade-offs where possible to reduce overall investments.

I would like to review for this Committee the major, mature technologies/system elements which could make up an effective defensive system. The hardware specifications for such an initial defensive system, Phase I, are not absolutely fixed; as continued progress is seen in the demonstration/validation effort, and in technology development, we may substitute or add more promising technology.

SENSORS

Boost Surveillance and Tracking System (BSTS). The BSTS is a missile launch warning system to detect launches of ICBMs and SLBMs. The sensors in BSTS satellites detect and track infrared emissions of a missile's propulsion system. Technology programs, ground demonstrations, and measurement programs are in process and focus on developing a complete understanding of the phenomenology and system design requirements. Ground demonstrations are scheduled to support both a system design selection and a full scale development decision in mid-year 1990. Currently, two contractors are finalizing their individual system design concepts. The first BSTS deployment is planned for the mid-1990s.

Space-Based Surveillance and Tracking System (SSTS). The SSTS is a constellation of satellites and ground stations. The primary sensing payloads of the satellite are a Long Wave Infrared (LWIR) passive sensor and a visible/ultraviolet passive sensor. The primary mission of SSTS is to track Post-Boost Vehicles (PBVs), target clusters, and Anti-Satellite Weapons (ASATS) to support defensive weapon engagement. The SSTS will also be able to track and discriminate a small number of RVs and perform foreign target signature collection and satellite tracking functions. The SSTS may provide weapon target assignment, fire control and inflight updates for Space Based Interceptors during post boost and early midcourse phases of flight. Initial design validation will be accomplished by an end-to-end ground demonstration scheduled for 1992 and will be the basis for downselection to a single contractor who will

produce the satellite.

Ground-Based Surveillance and Tracking System (GSTS). The GSTS is a fast-response, two stage, rocket-launched long wavelength infrared (LWIR) sensor system boosted into suborbital flight for use in the midcourse phase. The GSTS sensor operation is integrated with SSTS and GBR operations to provide track and discrimination. GSTS sensors are launched on selective trajectories based on early attack assessment data provided by the BSTS, SSTS, and other early warning sensors. The GSTS sensors would not be committed until the threat is launched to provide best GSTS inventory usage to increase the overall effectiveness of the SDS. GSTS enhances strategic defense robustness by providing a reconstitution capability in the event of an SSTS outage, to fill gaps in SSTS coverage, and to augment SSTS viewing in high density traffic situations.

A single contractor is developing concepts and multiple sensor designs. Sensor design will be selected based on technology experiments and sensor test bed results. A flight-qualified payload design will be developed and then fabricated for hardware-in-the-loop ground test demonstrations in FY92.

Ground-Based Radar (GBR). The Ground-Based Radar -Experimental (GBR-X, formerly named the Terminal Imaging Radar) is a phased-array, technology demonstration radar to be used for experiments at the U.S. Army Kwajalein Atoll for multi-target acquisition, tracking and discrimination in the midcourse and high endoatmospheric phases. It will accept hand-over from other midcourse sensors. The previous radar design was modified

in 1988 to operate in the midcourse region. This design facilitates integration with both ground and space based interceptors. The follow-on Ground-Based Radar program will develop a tactical, late midcourse defense radar to meet the ballistic missile threat, as an deployment system option for the SDS.

DEFENSIVE INTERCEPTORS

Ground-Based Interceptor (GBI). The GBI is an exoatmospheric interceptor to perform preferential and adaptive defense of selected targets. A Demonstration/Validation flight test series is intended to demonstrate, in FY 90-91, a LWIR seeker against a representative target complex (including decoys and countermeasures). Preparations are being made to develop and integrate the advanced technology required for engineering development. We plan to flight test these technologies in the 1991-92 time frame.

Space-Based Interceptor (SBI). SBI obtains the maximum defense leverage by intercepting boosters and post-boost vehicles before they have a chance to deploy reentry vehicles and clouds of decoys. SBI also has the additional capability to intercept re-entry vehicles and anti-satellite weapons, as the threat changes, with increased defensive benefits. Although the present architecture calls for SBIs to be garaged in groups of ten, the interceptors could be deployed as free flying "singlets" as proposed in the "Brilliant Pebbles" concept, with modification to battle management and surveillance requirements.

Technology simulation and tests are in progress to support the optimization of a low cost SBI. In particular, hover

testing at Edwards Air Force base and Sensor/Sensor Processor testing at Eglin Air Force Base in FY89 and FY90 will investigate the bounds of interceptor performance. These ground tests will be augmented, in the FY90 to FY92 period, with ballistic tests of SBI subcomponents at the White Sands Missile Range. In FY93, ballistic intercepts will be conducted at the Kwajalein Missile Range. These tests will complete preparation for a Full Scale Development Decision in FY94.

BATTLE MANAGEMENT/COMMAND, CONTROL, COMMUNICATIONS

This component has been designated the Command Center/System Operation and Integration Functions (CC/SOIF). The Command Center element will provide positive, survivable, and secure human control over the SDS. It will consist of fixed and mobile units and a terrestrial communications network with ground entry points for interconnectivity to the space components. CC also supports coordinated offense-defense operations and interfaces with other U.S. government agencies.

The System Operation and Integration Functions include the distributed information processing network needed for the automated execution of a human-selected battle plan. This requires both the assured, secure exchange of information between the CC and all SDS elements, and the data processing to identify targets, allocate weapons, execute the defense and assess its success, and manage the system's resources.

A baseline CC/SOIF architecture has been identified, with automated decision functions allocated to interceptor and sensor elements. Software policy, based on the recommendations of the Defense Science Board, emphasizes standardization,

supportability, risk reduction, security, reusability, and documentation.

In the coming year, the CC/SOIF program will:

- Develop a pilot Command Center experiment to resolve issues,
- Develop and refine Sensor Planning Algorithms for the Phase I design,
- Conduct advanced CC/SOIF simulations to test integrated system operations,
- Refine the content of ongoing experimental activities,
- Accelerate the use of available data from multiple experiments.

An Experimental Version of the CC/SOIF element should be available in FY 1994, with prototype CC/SOIF participating in realistic integrated tests with other SDS elements beginning in FY 1996.

ADVANCED TECHNOLOGIES.

Subsequent deployments, necessary to maintain and improve the initial defensive system capability, may include some or all of the following major candidate systems, depending on the threat response and the technological progress. Or, if more promising, one of these could be moved to the initial phase. There are still many unknowns associated with these technologies and a significant investment is necessary to resolve the unknowns.

Singlets. The concept of a singlet, in which the total surveillance is built into the interceptor, is embodied in a concept called Brilliant Pebbles. This interceptor would be

completely autonomous. Given a release command, the interceptor would use its own sensors to acquire a target and engage it without external tracking data or other assistance.

The interceptor should be low cost because it is derived from pervasive use of miniaturized commercial and military "off-the-shelf" high technologies, including miniaturized high-resolution/wide-field-of-view video imaging systems that work from the mid-UV to the mid-IR range, a super computer with Cray-I performance operating off high-energy-density "D-cell" sized batteries, a miniaturized high-power laser imaging radar/communications system, and a high-mass monopropellant propulsion system.

This interceptor's passive features -- small size, low cost, autonomy, and dispersal ability as singlets -- would be jam resistant, provide low-detection cross section, enable interceptors to be supplemented by decoys, and provide low value per individual target. These features would be supplemented by a full nuclear survivability suite and extensive maneuver capability for breaking track, evasion, and antisimulation in conjunction with constellation decoys.

High Endoatmospheric Defense Interceptor (HEDI). HEDI is a hypervelocity missile with a non-nuclear warhead that provides endoatmospheric (terminal phase) defensive coverage against ICBMs and SLBM RV's. The contribution of HEDI to the SDS architecture would be an additional defensive layer to further reduce RV leakage rates. The HEDI research is focused to resolve technology issues dealing with aero-optical effects, window and forebody cooling, shroud removal, non-nuclear warhead

kill and guidance and controls. The FY90 request supports the second major flight experiment (KITE-1) in which the IR passive seeker will be demonstrated, and several key ground tests to obtain significant optical and thermal data. The HEDI project is probably the most mature follow-on element and could enter into Demonstration/Validation (a Milestone I decision) in FY 90, if required.

Neutral Particle Beam (NPB). Orbiting stations would produce beams of neutral particles sufficient to destroy boosters and reentry vehicles, and provide interactive discrimination between warheads and decoys. A Milestone I decision is planned in the early 1990s, with a Milestone II decision in the mid-1990s.

Space Based Laser. Orbiting stations would produce laser beams sufficient to destroy boosters, post-boost vehicles, provide interactive discrimination, and provide self-defense capability for SDS elements. A Milestone I decision is planned for early 1992, with a Milestone II decision in the mid-1990s.

Ground Based Free Electron Laser (GBFEL). Protected sites in the United States would produce high energy laser power, relayed through space by mirrors, sufficient to destroy boosting missiles and to provide interactive discrimination. A Milestone I decision is planned for the early 1990s, with a Milestone II decision in the mid-1990s.

There are many other components of the SDI research effort, each with a supporting series of technology base research and experiments. Examples are the many sensors, processors and control elements associated with the sophisticated acquisition,

tracking, pointing and fire control necessary to orchestrate the multiple autonomous functions of the directed energy systems. We have attempted to detail in the Report to Congress the complete extent of the research.

The Report to Congress on the SDI program also contains information regarding SDI's compliance with the ABM Treaty. As has been the case since the SDI program inception, planned tests and experiments for fiscal years 1990-91 are in full compliance with the ABM Treaty. All tests are reviewed in detail by the Department of Defense (DoD) Compliance Review Group to assure such compliance. This review process is a deliberate, vigorous study of plans and treaty consideration.

Last year's Defense Authorization Act (Section 224) required a report on the feasibility of an accidental launch protection system. As you are aware, the Administration is conducting a comprehensive strategic review. The Department is very actively involved in that review, which includes consideration of the optimal SDI program. The Report on ALPS will be submitted as soon as possible upon completion of that review.

I would like to touch briefly on one other item before I proceed to highlight our technical progress this past year. You may be aware that the SDI research involves our Allies. The President's original guidance and SDI's charter reflected a concern for both U.S. and Allied security and stressed the development of ballistic missile defense technologies for threats of all ranges. Most of our Allies support the SDI research effort and, within the established DoD competitive

contracting procurement procedures, are actively participating with valuable technical contribution to the program. Since, SDIO's mandate extends to examining technologies for theater missile defenses, the Fiscal Year 1990 program will include analyses, technology developments and experiments that will improve our understanding of the theater defense problem. Technical programs include hypervelocity gun experiments, radar analyses, lethality studies, and theater test bed development. In several cases, our Allies are working cooperatively with us as we proceed in this area. A notable experiment will be the U.S./Israeli missile engagement experiment titled ARROW.

SDI research accomplishments have increased our confidence that strategic defenses will prove feasible. In past years, the SDI Organization has conducted a series of kinetic energy and directed energy weapon technology tests. Kinetic energy tests have successfully demonstrated the capability to intercept and destroy -- by non-nuclear means -- enemy ballistic missiles before they reach their targets. The first of a series of "hover tests" of a space-based interceptor have been conducted in a ground test facility. These tests help evaluate the capability of fast acting thrusters to keep a sensor pointed at a target, and the interaction of the sensor and guidance systems. This past year the Aerothermal Reentry Experiment (ARE) demonstrated that kinetic energy weapons can destroy warheads not only with a perfect hit, but also by inflicting damage with a less than perfect collision. ARE demonstrated the process of self-destruction of a damaged warhead as it enters the atmosphere. We will continue work over the next two years

toward integrated flight tests which will demonstrate with sufficient confidence that ground-and space-based interceptors can in fact satisfy the requirements for the first phase of a defensive system.

With directed energy experiments, researchers have demonstrated several key principles related to the operation of a large Free Electron Laser, a weapon which could become powerful enough to destroy enemy ballistic missiles in the boost and post-boost phases of flight. The Free Electron Laser has demonstrated lasing which shows wavelength scaling beyond that needed for an operational defense system. Similar experiments are also being conducted using other types of lasers and neutral particle beams. While lasers and particle beams will not be available as soon as some of the kinetic energy systems, their importance to the overall SDI mission cannot be overstated. Although such systems would build on the capability of an initial system, they would have at least one new mission: to thwart the effectiveness of a new generation of Soviet ICBMs and other possible counters to an SDS. Kinetic energy systems, lasers, and particle beams form what might be considered a mutually reinforcing "triad" of defensive systems much like the mutually reinforcing and complementing aspect of the offensive Triad. Additionally, by following the system design approach which we call "branch and block," we can frustrate threat evolution by maintaining an ever present capability to expand the SDS to meet the threat.

We have continued to exploit the successes of earlier experiments which demonstrated substantial improvements in our

ability to develop sensors necessary for strategic defenses. Last year's DELTA 181 experiment provided valuable information on the signatures of midcourse targets. The assortment of active and passive sensing instruments accurately characterized the test objects, and also the launch of a research rocket, in a variety of space environments. This data is being used to develop effective algorithms for discrimination between decoys and reentry vehicles.

Some surveillance and sensor technologies supported by the SDI program address not only SDI but other critical national security needs as well. The capabilities of today's early warning radars and satellites could be greatly improved through advancements in detection capabilities. New sensors will provide more accurate and reliable surveillance data of objects in space.

Tangible, impressive results have given us increased confidence that strategic defenses are feasible. Our progress has been excellent but we still have much left to do. Unanswered technical issues exist even though we are making great strides in fully understanding strategic defenses. The principal uncertainties of ballistic missile defense have been recognized for several years; these center around three issues: 1) assured survivability of space-based elements, 2) early interception of boosters and post-boost vehicles, and 3) discrimination. We have programs actively pursuing resolution of each of these issues.

Our schedule for the next two years includes a number of very important tests and experiments. Again, each of these is

fully compliant with all treaty obligations. I would like to briefly highlight a few upcoming projects and experiments, their contribution to the research program and the issues which will be addressed (from the three listed above).

<u>Experiment</u>	<u>Objective</u>	<u>Issues Addressed</u>
Delta Star	Collect multispectral imagery of rocket plumes and the near-space environment.	2, 3
Beam Experiment Aboard Rocket (BEAR)	First test of a Neutral Particle Beam in space.	1, 2, 3
Laser Atmospheric Compensation (LACE), Relay Mirror (RME), Experiment	Space test of relay mirror and atmospheric compensation process for ground based free electron laser.	1, 2
STARLAB	Space test of tracking/ pointing, sensor and communication technologies.	1, 2
Space Power Experiment Aboard Rocket (SPEAR) II	Space test of high power electricity applications.	2
Airborne Optical Adjunct Infrared Experiment	Airborne test of LWIR sensor.	2, 3

The budget request supports both Phase I and technology for follow-on phases. Phase I elements are currently in the Demonstration/Validation phase of the Defense Acquisition process and will enter Full Scale Development in the next 3-4 years. This system will support the minimum requirements, established by the Joint Chiefs of Staff for a strategic defense system that has military utility. Subsequent phases will build on that system, as necessary, to maintain military utility.

I am happy to answer any questions you may have.

710 Mr. DELLUMS. Thank you very much, General Monahan, for
711 your opening statement and the Chair would like to indicate
712 to my colleagues that, as you are aware, normally the Chair
713 has deferred to my colleagues to ask questions and reserved
714 the Chair's time to ask questions at the end of the debate,
715 but I would like to depart from this today. There are
716 several important questions that I think need to be raised,
717 and the Chair would like to raise them at the outset of
718 these hearings in the hope that it will aid in the
719 clarification as the debate goes forward.

720 General Monahan, I realize that you are new to this job.
721 President Bust does not at this moment have a Secretary of
722 Defense. The strategic review is taking place and a budget
723 reassessment is also taking place. Those limitations
724 notwithstanding, I do choose to proceed with some questions
725 in the hope that you will be able to answer the questions in
726 whole or in part.

727 My first question goes to the conceptual issue of the
728 Strategic Defense Initiative. Now, President Reagan had a
729 vision of SDI as a laser-based population shield which,
730 while politically appealing, apparently had little basis in
731 the actual direction of the Strategic Defense Initiative
732 Office and program spending. Most SDI funding, however, was
733 actually directed at developing systems to protect missiles,
734 not people, and using the so-called more mature existing

735 technologies.

736 The initial pronouncements of President Bush have
737 apparently down-played what I perceive to be this
738 unrealistic population shield concept or what we call the
739 Houston Astrodome mentality. Would you comment on the Bush
740 Administration's position concerning the direction and
741 emphasis of SDI under the Bush Administration and can we, at
742 this point, dispense with the public relations approach and
743 now debate the advisability of proceeding with an anti-
744 ballistic missile defense system to protect our land-based
745 deterrent forces so that the debate now will occur on
746 whether there is efficacy in going forward with the land-
747 based--a system to protect our land-based missile system and
748 get away from the discussion of population shield as a
749 nonviable option?

750 General MONAHAN. Sir, as I mentioned earlier, and you *also*
751 mentioned, we have the strategic review under way and I
752 think the president's views will come out as that review is
753 completed and as he has the opportunity to review ~~that~~ and
754 included in there will be what the pathway should be for
755 SDI among other things. So that is where that will come
756 from.

757 Just a couple of other comments, however. Protecting
758 people or protecting systems--a space-based interceptor, a
759 space-based system that I described, can protect anything

760 | you want it to protect in the entire world. I don't care
761 | what it is, you can protect it, people, places, wherever.
762 | In the ground-based system, again, you have the choice.
763 | You can--depending upon how many ground-based interceptors
764 | and radars and GSTSS we would deploy, we can protect the
765 | entire United States or the entire North American continent
766 | or wherever you want to put them. You are just wide open to
767 | *choose.* ~~choice~~ as far as that is concerned. Don't ~~anybody~~ make the
768 | mistake, however, of saying that all reentry vehicles or all
769 | missiles coming our way would be shot down. That is just
770 | not, I don't think, going to happen. But nevertheless, the
771 | system ought to be designed to be robust enough to shoot
772 | down a large number.

773 | You can design a system to protect whatever it is you
774 | choose, people, places, things, and you probably can be able
775 | to do all.

776 | Mr. DELLUMS. So I can conclude from your comment that
777 | this debate will continue to go forward as population shield
778 | and point defense simultaneously? You don't perceive
779 | whether some decision will be made to abandon this broader
780 | concept, because many people in Washington believe that what
781 | is envisioned at this point is focusing in on a point
782 | defense system, as opposed to this population shield that
783 | President Reagan sold to the American people as an Astrodome
784 | over the nation?

785 You just think that that decision is not going to be made
786 at this point?

787 General MONAHAN. No. First of all, as I said, there are
788 just so many options as to how one may go about it and how
789 large an area we wish to protect. Depending upon how many
790 interceptors, radars, and et cetera the country should wish
791 to have and you want a limited protection system, that sort
792 of thing. Do you want to start off small and grow? There
793 are a lot of different options there that could be pursued.

794 Mr. DELLUMS. My second question goes to the issue of the
795 nuclear energy--use of it in this system. As you know,
796 President Reagan has made much of the program being non-
797 nuclear, and on a number of occasions to the American
798 public, stated that this system was non-nuclear.
799 Nevertheless, substantial SDI funds have gone to examining
800 nuclear energy, both as a power supply and a source of
801 weapons, including orbiting nuclear reactors and x-ray laser
802 programs.

803 Would you comment, General, on the role of nuclear energy
804 as both a potential power source and a weapon source within
805 SDI? Can we now openly recognize that a significant part of
806 the SDI program is, in fact, nuclear?

807 General MONAHAN. First of all, Mr. Chairman, the entire
808 phase 1 system is non-nuclear. There is nothing nuclear in
809 it at all. Where you will find nuclear type work is in

810 looking at the advanced systems and the power supplies for
811 the advanced systems in particular. I described a space-
812 based laser and ~~a ^{it} space-based laser may~~ may need a nuclear
813 power supply to be effective. We don't know yet, but
814 because that is the case, we have technical work under way
815 on nuclear power sources in space, just as the Soviets
816 already have today. ~~We don't have, but~~ the Soviets do have
817 ^{nuclear power sources in space,} so we do have work under way to see ~~you know,~~ ^{what?} can we ^{can} do that
818 and if we need it for a space-based laser, that is the major
819 reason.

820 But the phase 1 system, today's system, the system ~~is~~
821 described in phase 1, which is quite robust, uses only
822 kinetic kill type vehicles, does not require nuclear energy
823 of any sort.

824 Mr. DELLUMS. General, you commented that beyond phase 1,
825 that--and you used the term "'may'" require a nuclear power
826 source, can you comment to the issue of the role of nuclear
827 energy as the source--weapon source beyond phase 1?

828 General MONAHAN. There is a concept of something called
829 an x-ray laser that would use a nuclear burst to generate
830 the lasing power and ~~that~~ in space ~~and~~ that is a concept.
831 Now, I don't know of--I am a little bit too new to the
832 program to know what kinds of funds we may have looking at
833 that particular effort.

834 Maybe someone else knows, but I can tell you--I think I

835 have learned in the past couple of months the major thrust
836 of this program, and that one has never come up. Whatever
837 is going on there--I don't know what it is--it has to be way
838 over on the back burner.

839 Mr. DELLUMS. General, my third question goes to the
840 debate regarding ABM Treaty. As you recall, there has been
841 a great deal of discussion in the Congress, both the House
842 and the Senate, with respect to questions of violations of
843 ABM Treaty, and there is a long lengthy discussion of the
844 narrow interpretation versus the broad interpretation, which
845 I frankly thought was a gross waste of time and an
846 irrelevant discussion that there is a much more basic and
847 fundamental question regarding SDI and ABM that was not
848 being touched in the narrow discussion of whether a broad or
849 narrow interpretation, but a much more fundamental issue
850 going to the logic of the ABM Treaty on the one hand and the
851 logic of the Strategic Defense Initiative on the other, and
852 my question is designed to elicit a response from you in
853 that regard.

854 The whole purpose, it seems to me, of SDI is to prevent
855 ballistic missiles from reaching our territory. By
856 definition, then, it is an anti-ballistic missile defense
857 program. Therefore, SDI would violate both the terms and,
858 in my opinion, the logic of the 1972 Anti-Ballistic Missile
859 Treaty.

860 While debate exists concerning at what point SDI tests
861 would technically violate the treaty, it would necessarily
862 be violated in the next several years anyway so the
863 discussion of whether this test or that test violates the
864 treaty, down the road, you are going to confront the treaty
865 in very real terms.

866 More important, SDI would lead to the same offensive and
867 defensive arms races that the ABM Treaty sought to avoid.
868 The treaty was agreed to because the parties understood that
869 absent the treaty, there would be a missile defense arms
870 race and a corresponding offensive arms race to overwhelm
871 the developing defenses system. SDI is, at a minimum, an
872 ABM system; thus the logic of ABM applies directly to any
873 SDI.

874 Therefore, is it not correct, General, that any deployment
875 of SDI would, by definition, be inconsistent with and
876 require an abrogation of the ABM Treaty?

877 General MONAHAN. I think the simple answer to that
878 question is yes. As I mentioned in my briefing, the
879 deployment of the space-based interceptors or ground-based
880 interceptors in excess of 100 ~~(100 are allowed)~~ ground-based
881 interceptors are allowed by the treaty. ~~In excess of that~~
882 is not in compliance with the treaty.

883 So you could not deploy the phase 1 system I described
884 with the treaty as it stands today.

885 Mr. DELLUMS. Thank you for your candor, General. I will
886 say to my colleagues that the significance of the General's
887 answer is that the debate over narrow versus broad
888 interpretation focuses on the issue of specific tests and
889 whether they violate the treaty, but as--what the General is
890 saying in very clear and unequivocal terms is that if you
891 are going to proceed with SDI, you are going to have to
892 abrogate the treaty, which means you have to come to grips
893 with that issue because the logic of the two are in direct
894 conflict with each other.

895 My next question is an offshoot of that. Even absent full
896 deployment of any SDI, the testing of SDI components, which
897 are by definition ABM components, would violate that portion
898 of the ABM Treaty. How can we proceed with development and
899 testing of SDI unless we are committed to the abrogation of
900 the ABM Treaty?

901 Also, could you comment on which specific SDI--and I am not
902 sure if you can do this now, but I would appreciate it if
903 you could--could you comment on which SDI program experiments
904 might possibly be construed as violating the ABM Treaty and
905 the date you anticipate that those particular experiments or
906 tests would be undertaken? You alluded to one. Is that
907 possible for you to discuss what you perceive a test that
908 would be violative?

909 General MONAHAN. I can just make this statement right

910 now, Mr. Chairman. All the tests that we have planned for
911 fiscal year 1990 and fiscal year 1991 are treaty-compliant.
912 We have already made that determination in the Treaty
913 Compliance Review Group and it has given us the go-ahead.
914 We have looked at some 25 or 30 tests and experiments right
915 now that have been determined to be treaty-compliant.

916 We are not putting any funds in the next two years into
917 anything, test-wise, that is not, indeed, treaty-compliant.

918 Beyond that, you need to take a look at the tests that
919 might be coming up ~~beyond that~~ even out beyond 1990 and
920 1991² on a one-by-one or case-by-case basis. ^{The} ~~and first~~ ^{issue is to} ~~of~~
921 ~~all~~ determine whether or not they are treaty-compliant and
922 then, secondly, ask ourselves the question, should we modify
923 the test in some way, shape or form so that it can be treaty-
924 compliant?

925 There is always the possibility of doing that. I have a
926 treaty expert here with me today, but I don't know if it is
927 useful to try to get into what specific tests may or may not
928 be treaty-compliant out in the future. Until you really
929 learn the real details of each test, you can't tell.

930 Like I say, we have already cleared some 25 or 30 tests.

931 Mr. DELLUMS. Thank you, General. I just have one
932 additional question, but I would like to make one comment to
933 my colleagues.

934 It is fascinating that a number of our colleagues who have

935 said, ''I oppose any abrogation of the ABM Treaty, but let's
936 go forward''--it seems to me that that position is a
937 contradictory position; that is you support ABM, that SDI
938 conceptually violates the logic of ABM and you can't stand
939 in that camp, it seems to me, for long.

940 My last question goes to the ALPS program, General, the
941 accidental launch protection system that some people are
942 talking about, and this is my final question and then I
943 would yield to my colleagues and maybe come back later for
944 some follow-on questions.

945 There has been some interest expressed in support of some
946 type of accidental launch protection system program. Some
947 version of ALPS are supposedly propagandized as treaty-
948 compliant, or at least the PR is that, that some type of
949 ALPS program would be ''treaty-compliant.'' My
950 understanding of the ABM Treaty is that territorial defense
951 is explicitly prohibited by the ABM Treaty and that
952 regardless of their being compliant with the ABM Treaty in
953 terms of the number of launches, 100--and you and I talked
954 about this briefly informally this morning--and numbers of
955 launching sites, for example, one, that any ALPS system to
956 be meaningful would have to provide territorial defense and
957 would, therefore, by necessity, have to violate the ABM
958 Treaty.

959 Can you comment to that, please?

960 General MONAHAN. First of all, I do know that deploying
961 an additional 100 interceptors is, indeed, permissible. Let
962 me check one other thing.

963 May I let Lieutenant ^{Colonel} George Ash respond? ~~to the~~
964 ~~territorial~~

965 Mr. DELLUMS. We agree on the 100 and the one site. The
966 main thrust of my question is that if the treaty
967 specifically prohibits territorial defense--if you are going
968 to have a competent accidental launch program, don't you
969 then, by necessity, have to violate the treaty?

970 Lieutenant ^{Colonel} ASH. Sir, I don't know that I can give you a
971 categorical answer. The ABM Treaty does prohibit
972 territorial defenses in Article 1, but the question of how
973 much of an area that you defend has to do with what the
974 mission of the ALPS, as you understand it and define ^{it to} be.
975 As the General said, Article 3 allows you to deploy up to
976 100 interceptors to defend a particular area, based upon the
977 sensors and the types of interceptors that you deploy.

978 But I don't think there is a position that an interceptor
979 that has a very large footprint is noncompliant with the ABM
980 Treaty. That decision just has not been made.

981 Mr. DELLUMS. I see.

982 Thank you very much.

983 The Chair would like to thank my colleagues for their
984 indulgence. I think these are some basic questions that

985 hopefully will clarify, at least in part, the debate as we
986 go forward.

987 The Chair now recognizes the gentleman from Arizona, Mr.
988 Kyl, for such time as he may consume, to be followed by Mr.
989 Dickinson and Mr. Foglietta.

990 Mr. KYL. Thank you, Mr. Chairman.

991 General, let me ask you some questions first about the
992 flight experiment, which was, of course, one of the key
993 aspects of last year's authorization debate and one of the
994 reasons that the president vetoed the authorization bill.

995 From what you testified to earlier in response to Mr.
996 Dickinson's questions--and incidentally, Bill, I neglected to
997 see you there. I should defer to you, particularly since
998 this was your question--all right, let me just continue,
999 then, onto your question.

1000 Because of the decisions early in our fiscal year debates,
1001 do I gather that decisions were made at that point which set
1002 an irrevocable course of action which precluded you, then,
1003 from rehabilitating the program after it was reinstated? Is
1004 that correct?

1005 General MONAHAN. That is more or less correct, whether or
1006 not irrevocable is, indeed--

1007 Mr. KYL. Well, irrevocable to have the tests conducted in
1008 December of this year, in any event?

1009 General MONAHAN. Right.

1010 Mr. KYL. My understanding is that, notwithstanding the
1011 fact that by the time the bill was signed by the president,
1012 that nevertheless the program is--the flights tests are still
1013 on hold, that the Air Force has recommended that they go
1014 forward, but SDIO has not yet signed off on that.

1015 Do you know whether I am correct?

1016 General MONAHAN. I could probably give you a much more
1017 definitive answer, Mr. Kyl, for the record, if I am able, if
1018 you would allow that, but we are planning for SBI tests
1019 downstream and I think it is the 1993-1994 timeframe. I
1020 believe that there just wasn't sufficient funding, as I
1021 understand it, left over finally this year.

1022 [Indicates to BG Schnelzer] Do you want to describe it more? Brigadier General
1023 Schnelzer was there during this and I was not. Perhaps he
1024 can give a more definitive answer.

1025 Mr. KYL. We would appreciate that, thank you.

1026 General SCHNELZER. If you go back to the cap of 85
1027 million, that was a reduction of 75 percent. It went down
1028 to four times less than what we had. Of course, ~~we~~ also ~~in~~
1029 the 1988 appropriation, ~~became~~^{it} the second quarter of the
1030 fiscal year. It was about a 30 percent reduction.

1031 If you combine those two factors, it had a tremendous
1032 impact on the SBI program.

1033 Mr. KYL. Excuse me, let's just be real clear on that.
1034 The debate that occurred approximately one year ago in the

1035 House of Representatives and the fact that the
1036 program--although it passed out of the full committee intact,
1037 was reduced by the time it finished floor action. That
1038 action alone was enough to stop the program, despite the
1039 fact that by the end of the year, and prior to the beginning
1040 of the fiscal year, it had been reinstated.

1041 General SCHNELZER. That is correct, Congressman.

1042 Mr. KYL. So that does demonstrate that our actions at
1043 this time of the year can have a very devastating impact on
1044 your planning.

1045 General SCHNELZER. Tremendous. In fact, we took a 30
1046 percent reduction in the total budget essentially given to
1047 us in January when the appropriation was made. If you
1048 combine a 30 percent reduction of that magnitude and combine
1049 restrictive language, what is forthcoming has a decided
1050 effect.

1051 Mr. KYL. Now, to make the point, therefore, what we
1052 authorized--and when the chairman talks about the necessary
1053 reductions from the Reagan budget--we are talking about
1054 actual tests, actual time lags and significant holes in the
1055 information that is required for further evaluation. But
1056 now to my question. What is the status of that now? You
1057 could put that back in the budget; you could conduct the
1058 experiments a year late, in December of 1990. Isn't that
1059 pretty critical for determination of where we go from here

1060 with SBI?

1061 General SCHNELZER. Yes, sir. We tried to recover as best
1062 we could. As you know, with the passage of the bill, the
1063 first of this fiscal year, we endeavored to increase that
1064 amount of money from \$85 million as much as we could and
1065 keep the integrity of the program intact. Our report to you
1066 in October, if I remember, was around 230^{million} 240^{million}; if I
1067 remember correctly. That was our estimate of what we
1068 thought we could put back into the program. We have not
1069 quite reached that, but we have increased the amount of
1070 money for SBI by over 2.3 times over the \$85 million cap.
1071 That is in the recovery.

1072 Our agent in this case, the Air Force, had to essentially
1073 start over in some regards ~~in terms of~~ with a new profile
1074 what made sense and they are looking at test flights in the
1075 1993-1994 timeframe.

1076 Mr. KYL. How can you reach the information for the DAB
1077 Milestone 2 evaluation in the 1993-1994 framework if you
1078 don't conduct those tests in 1990?

1079 General SCHNELZER. Sir, I think ^{the perception} ~~we kind of misled by the~~
1080 ~~fact~~ that there is one significant test ^{is misleading}. There are a whole
1081 series of tests. I will give you an example.

1082 This past year, we had a very key milestone take place at
1083 Edwards Air Force Base. We took the motor itself and
1084 conducted a test that showed that it, indeed, could provide

1085 the necessary motion as guided by its navigational unit.

1086 That took place this year.

1087 This spring, we will have another key test. They will
1088 actually have a sensor in front looking out of this test
1089 chamber where you actually tie the whole device together
1090 from the point of the sensor looking at a target to
1091 controlling its motors. That is a key test.

1092 There are a whole series of tests that evolve up to what
1093 we call, I guess, the very large flight test that would take
1094 place in the 1993-1994 timeframe. But those are very
1095 definitely incremental.

1096 The star flight that we have coming up, ~~pending very, very~~
1097 ~~quickly~~ carries the kinds of sensors that would be
1098 appropriate to investigate how a space-based interceptor
1099 sensor would work. That data is extremely important. So
1100 what we have done with--in fact, as the chairman said, with
1101 our yearly reductions of 30 percent, we have kept intact
1102 what we think is a viable program, a balanced program,
1103 reflecting that vital engineering and technical data that
1104 allows us to make, I think, reasonable engineering decisions
1105 on what a space-based interceptor is.

1106 Mr. KYL. This particular flight experiment was
1107 represented to us as treaty-compliant, and my understanding
1108 is that it still would be. So the total time for slippage
1109 of this program, then, would be how many years?

1110 General MONAHAN. I don't know that you could really
1111 measure it in terms of years. As General Schnelzer said,
1112 there are an awful lot of test events that are still going
1113 on, that are still scheduled to go on.

1114 Out of the original request of 330 million, you know,
1115 there is about 130 million lost, so that just called for a
1116 very substantial restructuring of the program. Whether or
1117 not anyone could accurately reconstruct to the point of
1118 saying, how much did you lose time-wise, I don't really
1119 know. We are now looking at a revision of the program again
1120 and concentrating more of our effort there rather than what
1121 went on.

1122 Mr. KYL. I guess it is not as important to establish a
1123 specific time that has been lost here as to establish the
1124 principle that our playing around with the funding and
1125 decreasing it from the requested amount has had a
1126 significant impact in delaying the program.

1127 Mr. DELLUMS. Would the gentleman from Arizona yield to
1128 the Chair for a moment?

1129 Mr. KYL. Certainly would.

1130 Mr. DELLUMS. I appreciate the thrust of the gentleman's
1131 questions, but it seems to me they can be turned around.

1132 The Chair's question is this: What curve are they using
1133 to plan? If, over several years, the Congress has been
1134 consistent in making cuts in the range of 20- to 30 percent,

1135 then it is one thing for them to plan on the curve of that
1136 consistency. That, it seems to me, one could argue might
1137 produce an efficient viable program. But if they continue
1138 to plan on a higher curve consistently year in and year out,
1139 then it seems to me very difficult to rationally argue that
1140 you can have a viable program planned out if that plan is
1141 always 30 percent above the reality and that is being done
1142 several years in succession.

1143 That was the thrust of the opening remarks of the Chair,
1144 so I would turn it around. While I think the thrust of the
1145 gentleman's questions put the burden of efficiency on the
1146 Congress, the Congress has spoken and it has done so
1147 consistently for about six years in the 20- to 30 percent
1148 range.

1149 So should the other guys get the message that maybe we
1150 ought to plan on that curve, as opposed to this unrealistic
1151 "I am going to ask them in the 5 billion range and plan a
1152 program that they can't carry out because the Congress
1153 consistently doesn't give them those kinds of funds." That
1154 is the question of the Chair.

1155 Mr. KYL. Was that a question or a statement, Mr.
1156 Chairman. I don't know whether the witness--

1157 Mr. DELLUMS. I think the General understands the thrust
1158 of my question. I mean, the question that I am asking is
1159 can you really say to the Congress that we are developing a

1160 viable plan when you consistently plan 20- to 30 percent
1161 higher than the Congress is willing to give you and you do
1162 that over several years?

1163 Mr. MCCURDY. Would the gentleman yield?

1164 Mr. KYL. I will as soon as I make a brief statement.

1165 You see, the point, Mr. Chairman, of my comment was that
1166 the Congress came back, in its wisdom, following the
1167 president's veto of the authorization bill, and restored the
1168 funding, but by then--so we didn't cut that particular \$230-
1169 some million, and yet, because of the actions--the
1170 machinations that we went through, their program was totally
1171 thrown off stride there. The program was, in fact--that test
1172 was, in fact, canceled and now, instead of just having the
1173 test a year later, they have gone back to try to put it
1174 together in a little different way, as I have heard it
1175 described, to conduct some other kinds of tests and perhaps
1176 this test, then, might not be conducted for another three
1177 years.

1178 Is that correct, General?

1179 General MONAHAN. That is right.

1180 Mr. KYL. Excuse me, Mr. McCurdy.

1181 Mr. MCCURDY. I just wanted to ask--really, on the same
1182 note, and that is, another way of doing it is how well can
1183 you--what trend or path can you continue if Congress does
1184 under-fund, based on your request, and realizing that there

1185 is a consistent pattern in that under-funding? Some of us
1186 who have supported higher funding realize quite frankly it
1187 is probably not going to continue as long as the goals
1188 appear to be loftier than that which Congress is willing to
1189 support.

1190 But if you were to go on an ALPS system or something else,
1191 do you have some alternative funding profiles that you are
1192 not telling us or do you continue, as Secretary Weinberger
1193 did for a few years, always come in high expecting to get
1194 low? I mean, you are either being grossly under-funded
1195 and--or you are overly optimistic or you have something you
1196 are not telling us.

1197 Where are we?

1198 General MONAHAN. Let me try to take that, Mr. McCurdy.

1199 First of all, when a budget comes over here, along with
1200 that is five-year defense plan. What you see are at least
1201 the first two years of it, and by the way, someone in my
1202 position--the thing he would like to have would be five
1203 years' worth of funding or even more than that tied up.

1204 In some countries they do it that way, you know. They
1205 vote the funding for the project, for the entire project,
1206 over a period of several years and then they stick with it.
1207 That is the prevent the ups and downs and ups and downs and
1208 funding instability associated with the program.

1209 RPTS TETER

1210 DCMN TETER

1211 So every time we send over a president's budget, we at
1212 least have programmed out what the program is for five
1213 years, and as you know, the president has submitted a budget
1214 this year that is to cover two years. That is at least a
1215 help, if not all five or six--what I would like to see--but at
1216 least it is the first two.

1217 So every time it gets changed--by changed, I mean when the
1218 amount finally authorized and appropriated ^{is} in, indeed
1219 different from that requested, then that, of course, upsets
1220 the plan, the five-year plan, and you have to go back and
1221 redo it and regroup. That occurs--with the SDI program, of
1222 course, it has occurred with some regularity. It occurs in
1223 other programs once in a while also.

1224 So if I had my druthers, I would like to see ~~a long~~ a much
1225 longer period of time that I could count on in pursuit of a
1226 program.

1227 Now, the next point, in the strategic review that is
1228 ongoing--obviously, in the strategic review, we are not
1229 looking at just the short-term; we are looking at the longer
1230 term, and we are looking at at least a five-year period, and
1231 indeed, even making some projections out beyond that.

1232 So what will emerge from the strategic review will be a
1233 plan for all of our strategic programs, as well as the

1234 Strategic ^{Initiative} Defense, and that will be the next plan. Budgets
1235 will be based on that; budgets will be put together on that.

1236 To the extent those budgets aren't supported, then,
1237 obviously, that will put instability into the plan or make
1238 us go back and replan.

1239 Mr. MCCURDY. If I can just clarify that a little more--and
1240 I wasn't trying to pose it as an impossible question, but--

1241 Mr. DELLUMS. Does the gentleman from Arizona continue to
1242 yield?

1243 Mr. KYL. Yes, I do.

1244 Mr. MCCURDY. Just on one point, and I appreciate the
1245 gentleman yielding.

1246 In May of 1988, the Defense Science Board made a
1247 recommendation that you separate--that you go ahead and that
1248 you go forward with the surveillance system, in addition to
1249 a separate track, but I think they realized that, one, the
1250 funding and the planning curve were not going together. So
1251 they said, let's separate and go ahead and do the
1252 surveillance track and have that as a separate course.

1253 Is that not a higher realization of the dynamics of
1254 whether it is Congress under-funding or--you know, whatever
1255 the realities are--but they realized that that is the first
1256 thing that you ought to go ahead and do and that--to continue
1257 to have a phase 1 as a total concept is unrealistic to date?

1258 General MONAHAN. I don't know if that is really so, Mr.

1259 McCurdy.

1260 First of all, in phase 1, as I showed, the things that
1261 come first are the sensors. BSTS is the first to enter full-
1262 scale development, followed by the other items there, and
1263 what comes last, as I recall, are the space-based
1264 interceptors.

1265 So phase 1 is more or less designed to do just that, but I
1266 mentioned also that the phase 1 response to a Joint Chiefs
1267 of Staff requirement--the Joint Chiefs of Staff requirement
1268 went further than just saying we need to see things; it also
1269 says we need to destroy ballistic missiles that would be
1270 incoming and so phase 1, then, is designed to respond to
1271 that requirement. Therefore, phase 1 needs to have the
1272 interceptors associated with them, as well as the sensors.

1273 I think that the phase 1, as approved by the Defense
1274 Acquisition Board, didn't go quite so far in doing sensors
1275 first and then interceptors. It really kept them a little
1276 bit closer together than that original proposal, but
1277 nevertheless, the sensors still do come earlier.

1278 Mr. DELLUMS. Does the gentleman yield back his time at
1279 this point?

1280 Mr. KYL. Yes, Mr. Chairman. I had intended to yield to
1281 my colleague, Mr. Dickinson.

1282 Mr. DELLUMS. Okay. Thank you.

1283 The Chair would like to indicate to my colleague that,

1284 | time permitting, we will get back to the gentleman. I know
1285 | he has a number of additional questions.

1286 | The Chair would now recognize Mr. Dickinson for such time
1287 | as he may consume.

1288 | Mr. DICKINSON. Thank you, Mr. Chairman.

1289 | Not to belabor the point, but to paraphrase what I
1290 | understood your agreement with the questions posed by my
1291 | colleague from Arizona, we protected, in the final
1292 | conference, the money that has been spent in the bill and
1293 | which some of us knew was wreaking havoc with the total
1294 | program and in conference, we--after the veto and reporting
1295 | of the new bill--we unfenced it and directed that nobody--none
1296 | of these major programs--there were four, as I recall, take a
1297 | disproportionate hit or cut.

1298 | Now, you are saying that there was a disproportionate hit
1299 | on the program, but that this has been caused by the
1300 | turbulence in the program or reduction of the program before
1301 | so that you had had to cancel and then lay off people and
1302 | you couldn't regenerate it.

1303 | Am I saying substantially what I understood the case to
1304 | be?

1305 | General MONAHAN. That is substantially correct, yes, sir.

1306 | Mr. DICKINSON. So the mischief was done before the veto
1307 | was enacted and--

1308 | General MONAHAN. Absolutely.

1309 Mr. DICKINSON. --before we--okay. So at least we tried,
1310 some of us did anyway.

1311 Let me get back to the point that--a very telling point,
1312 that my chairman raised with you, dealing with the ABM
1313 Treaty and the SALT I, SALT II. I think you agree, and I
1314 agree, that at some point, there has to be a resolution of
1315 do we go forward with the SALT II or SALT III; are we, in
1316 fact, headed on a collision course where it would be
1317 violated?

1318 You have said yes, at some point, if we continue
1319 everything that we have on the drawing board, that we will
1320 probably violate the--they will abrogate the treaty, even
1321 though we don't have a treaty. But on the opposite coin, we
1322 know, in fact, that the Soviets have a substantial effort
1323 ongoing also.

1324 Is this correct or not?

1325 General MONAHAN. The Soviets have a deployed ABM system.

1326 Mr. DICKINSON. Well, aside from the system, within--that
1327 is the 100 Gulash around Moscow. But we also know they have
1328 a rather robust SDI-type program ongoing also, do we not?

1329 General MONAHAN. We know they have some research efforts
1330 under way, yes.

1331 Mr. DICKINSON. That is a pretty weak answer from what I
1332 understand.

1333 General MONAHAN. Beyond that, Mr. Dickinson, I think I do

1334 start to get classified.

1335 Mr. DICKINSON. Maybe we ought to flush the room and get
1336 the facts. The fact is, as I understand it, that the
1337 Soviets and us, the United States, are probably paralleling
1338 each other's efforts pretty substantially. Maybe we are
1339 going in some directions differently, but at some point,
1340 they are going to be faced with the same choice that we are.

1341 They have a robust R&D effort dealing with the types of
1342 programs that we are dealing with and if we sit on our hands
1343 because we say, "Well, we can't do anything because we
1344 might run afoul of the treaty," then we will, in fact, be
1345 in the soup, so to speak, because the Soviets--they are
1346 progressing apace with us, as far as we know. We have
1347 reason to believe that is true and that--these are my words,
1348 not yours, and you can confirm or deny that in a classified
1349 session, but the point being, if we don't go up to that
1350 point and then have a resolution on whether or not there
1351 will be a new SALT, then the Soviets will have no reason to
1352 enter into a new SALT. They will have that capability. We
1353 will not have developed anything to entice them to come and
1354 negotiate a new treaty and so we will have dealt ourselves
1355 out of the game completely.

1356 Would you agree with that?

1357 General MONAHAN. We can do an awful lot technically under
1358 the treaty as it is today. If I gave an impression that I

1359 | can't do this unless you change the treaty, that is entirely
1360 | wrong. I mean, we can and should do an awful lot of work
1361 | here.

1362 | Mr. DICKINSON. I am not making myself clear. The
1363 | chairman said, and I agree with him, that if we proceed
1364 | along the lines that have been laid out for SDI, and go
1365 | forward with the plans, at some point, we will run up
1366 | against the treaty and have to make a decision to abrogate
1367 | it or not; is that right?

1368 | General MONAHAN. Yes. Yes, sir.

1369 | Mr. DICKINSON. Okay. So we are not planning to abrogate
1370 | the treaty at this point until at least we know that the
1371 | Soviets are. If we don't go forward with our research and
1372 | development efforts up to that point, then there is no
1373 | reason to ever think that the Soviets would enter into
1374 | another treaty because there is no reason to, where they
1375 | have the capability and we don't.

1376 | Would you agree with that?

1377 | General MONAHAN. I would say that is indeed possible. I
1378 | am not an expert on arms control, Mr. Dickinson, but it
1379 | strikes me that what you say is--

1380 | Mr. DICKINSON. I am really asking you about the tenor and
1381 | the tone and the direction of our development, research and
1382 | development efforts. We know where they are going and we
1383 | know at some point we have to either renegotiate with the

1384 Soviets or else we will both abrogate and go forward.

1385 Let me ask you a little more mundane question. We know
1386 that in order for a ground-based laser to be effective that
1387 you have to deploy satellites and mirrors to deflect and
1388 reflect the laser beam itself. The biggest problem--or one
1389 of the biggest problems is going through the atmosphere. Am
1390 I right so far?

1391 General MONAHAN. Yes, indeed.

1392 Mr. DICKINSON. Okay. Does it make sense, is it practical
1393 and are we experimenting with the concept of putting such a
1394 power system on an aircraft that could take it up through
1395 most of the atmosphere? Is that reasonable? Or have we
1396 discounted that?

1397 General MONAHAN. I would have to ask--you know, we used to
1398 have an airborne laser laboratory and we finally grounded
1399 it. Maybe those are the reasons why. You would have to get
1400 an awful lot of power onboard that airplane and the big
1401 problem with doing that is power on airplanes.

1402 Mr. DICKINSON. I know that is a problem, but it also
1403 reduces the requirement the higher you get, so the question
1404 is, do we have an ongoing experiment--have we tried that and
1405 discarded it as not practical?

1406 General MONAHAN. ^{Dr.}Mr. Mike Griffin, our technology expert--

1407 Mr. DICKINSON. Okay.

1408 ^{Dr.}~~Mr.~~ GRIFFIN. Just to comment very briefly, the main

1409 | problem in putting a laser such as you describe on an
1410 | airplane in place of the ground-based free-electron laser or
1411 | other laser concept would be the power source required on
1412 | the airplane. Now, we are looking at--you didn't ask this
1413 | question, but we are looking at space-based applications of
1414 | that laser. That is in a follow-on timeframe to the current
1415 | GB FEL work that is ongoing in the technology directorate.

1416 | But for airplane use, we don't see the availability of a
1417 | compact power source at this time.

1418 | Mr. DICKINSON. Even though the higher you get, the less
1419 | energy it would require--you still wouldn't have enough to--

1420 | ^{For} Mr. GRIFFIN. That eases the atmospheric compensation
1421 | problem, but it does not alter the requirement for laser
1422 | brightness to a significant degree. That is a power issue.

1423 | Mr. DICKINSON. So, for that reason, we would go to space-
1424 | based laser, rather than try to develop some aircraft that
1425 | would do that?

1426 | ^{D.} Mr. GRIFFIN. That would be the thinking at this time. If
1427 | there is a breakthrough in compact energy storage or
1428 | something of that nature, then it would be time to
1429 | reevaluate.

1430 | Mr. DICKINSON. In closing, Mr. Chairman, and I don't want
1431 | to monopolize all the time, it is my recollection that the
1432 | ABM Treaty that was agreed to was put in place based on the
1433 | concept--on the logic that we would put this SALT treaty in

1434 place and then that we would have a reduction in offensive
1435 weapons. Then we observe that for whatever the period was,
1436 seven years, and then we negotiate a SALT II, which was not
1437 ratified, but since then, we have not seen the reduction in
1438 weapons that the first and second treaty envisioned--did
1439 envision.

1440 So it was not ratified and so you can't--we can't always be
1441 held to that since--when the first treaty was put in place,
1442 we didn't have a concept of SDI, and so all this has been as
1443 a result of developments since; technologies have been
1444 recently developed; they were never envisioned when the
1445 treaty was put in place.

1446 So at some point, we have to make another determination:
1447 Do we want a new treaty with the Soviets and then what will
1448 that treaty encompass and will the Soviets then come to the
1449 table based on the fact that they are assured that we have a
1450 capability also or will they say, "'Who are you kidding; you
1451 don't have any effort going worth mentioning and we have a
1452 robust system and we don't need a treaty?'"

1453 Thank you, I yield back.

1454 Mr. DELLUMS. The gentleman yields back his time.

1455 Mr. Foglietta is recognized for such time as he may
1456 consume.

1457 Mr. FOGLIETTA. I thank you, Mr. Chairman.

1458 General Monahan, in 1983, I remember attending a breakfast

1459 at which the speaker was Dr. Edward Teller, and he
1460 conceptualized what he believed could be the development of
1461 the SDI program.

1462 Today, except for the reduction of sophistication of some
1463 of those concepts into sketches, and as I see the reduction
1464 in size and the expansion and efficiency of some component
1465 parts, and after the expenditure of some \$14.7 billion, I
1466 don't see much of a development from the concepts expressed
1467 by Dr. Teller six years ago.

1468 Is that because this is an unclassified, open hearing and
1469 would it be different if it was a closed hearing?

1470 General MONAHAN. I don't believe that that would make a
1471 substantial difference, whether or not we were closed, in
1472 that particular point. I think what you are finding is that
1473 the program is getting now to the stage where you are going
1474 to see an awful lot more in the way of hardware that has
1475 been developed and is now in an experimental stage.

1476 I am just trying to--somewhere in here I think I have a
1477 list of all the tests that we plan for the next two years
1478 and it is, indeed, this long, and there will be substantial.

1479 For example, we will have a beam experiment aboard rocket
1480 here just next month and there are quite a few. Here is an
1481 entire list of them right here and I could furnish these to
1482 you.

1483 Also, in the Report to Congress which we submitted--the

1484 classified version in January and then the unclassified
1485 version just today--you will find these laid out. I think
1486 that would give you a better indication of just where we
1487 are.

1488 Mr. FOGLIETTA. Have we advanced--or to what extent have we
1489 advanced in the development of these technologies that we
1490 heard about six years ago?

1491 General MONAHAN. We have advanced to the extent that we
1492 ~~have decided to~~ (First of all), we are able to finally
1493 coalesce them down into the various elements that I showed
1494 today, and it takes advancing technology to get them down to
1495 figure out, yes, indeed, this is the way now that it ought
1496 to be packaged, and know that you have a very good chance
1497 that they will work.

1498 Then, having done that, now we have taken them into the
1499 next stage of development, which is just short of full-stage
1500 development. We call it the demonstration and validation
1501 phase. So all of those elements in the phase 1 system are
1502 in that phase today, except for the ground-based radar,
1503 which is just about to enter DEVELOPMENT

1504 That says that you have advanced the technology far enough
1505 so now you are at the point of being able to test a certain
1506 amount of hardware and now you can start narrowing down your
1507 specifications so that in a couple of years, when you get to
1508 the full-scale development phase, you are up and you are

1509 ready to go.

1510 In the spending, you know, spending has been--by
1511 comparison, has been like this at the present time and when
1512 you get into full-scale development, then it would rise
1513 further.

1514 Mr. FOGLIETTA. I also see a book that was distributed
1515 here promoting the SDI technology transfer to the United
1516 States public and private sectors. Suppose we had diverted
1517 the \$14.7 billion over the last five or six years to
1518 commercial research. Do you think that would have been
1519 advisable?

1520 General MONAHAN. The president established the SDI
1521 program. First of all, what he did was, in establishing the
1522 SDI program, we brought together many technology efforts
1523 that were under way out there, but they were fragmented, and
1524 they weren't integrated properly. So an awful lot of what
1525 you see here and what SDI has done for the past five years
1526 is effort that was already on the books and people had
1527 already planned to do.

1528 I think you are into some very key technology areas here,
1529 as Mr. Dickinson mentioned. The Soviets aren't stopping out
1530 there. There is no question about that, although I can't
1531 get into details with you, but they are looking at it very,
1532 very robustly, at a lot of areas of technology. So, if we
1533 don't, we do so at some great peril.

1534 I think that the money has been, indeed, very, very well
1535 spent, even if you went no further in the program. I don't
1536 advocate that, but that is the case.

1537 Mr. FOGLIETTA. I thank you, General.

1538 I yield back the balance of my time.

1539 Mr. DELLUMS. The gentleman yields back his time.

1540 Mr. McCurdy is now recognized for such time as he may
1541 consume.

1542 Mr. MCCURDY. Thank you, Mr. Chairman.

1543 General, since you have taken over in February--we
1544 understand that there is always somewhat of a transition and
1545 a learning curve and that is occurring at the same time we
1546 have a new administration with a transition.

1547 I am curious, since we have been addressing this over the
1548 past five years, how much change there has been in SDIO.
1549 How many personnel are within the organization at this
1550 point?

1551 General MONAHAN. In the ^{SDI} organization, in the Pentagon,
1552 about 260 people.

1553 Mr. MCCURDY. Two hundred and sixty?

1554 General MONAHAN. Two hundred and sixty, yes, sir.

1555 Mr. MCCURDY. What percentage of turnover would they have
1556 had in that group? Have you had high turnover of
1557 scientists? Have you have had a fairly constant group
1558 there?

1559 General MONAHAN. I haven't been there long enough to
1560 note, to tell you truth.

1561 Mr. MCCURDY. Do any of your briefcase carriers back there
1562 have any?

1563 General MONAHAN. They might, but I don't think it is been
1564 inordinate one way or the other. I will tell you this, if
1565 you can find any better scientists and engineers somewhere,
1566 in government or in industry, be my guest. They really are
1567 an excellent crew.

1568 Mr. MCCURDY. I was curious--I am not trying to be
1569 sarcastic; I am curious whether or not you had difficulty
1570 attracting, and if so, is it an issue of how much you can
1571 pay, the degree of challenge, the science, the love of the
1572 challenge itself? It really goes to these--you know, the
1573 young technician that you had come up there--are you having a
1574 hard time recruiting people like this or do they come, stay
1575 a year and go off to Lockheed or somebody at three times the
1576 salary? What is the--

1577 General MONAHAN. I don't think the program has enough
1578 experience just yet to know whether or not enough people
1579 would turn over and move on out to jobs in industry.
1580 Because of the nature of this program, I think we are a
1581 magnet for very bright people, and I think that is probably
1582 what sets SDI apart from other programs. I think in other
1583 areas within the government, we clearly do have a lot of

1584 difficulty attracting the kind of scientific and engineering
1585 people that we need to have.

1586 Mr. MCCURDY. DARPA, for instance, testified a few weeks
1587 ago that they actually have a policy of having turnovers.
1588 Again, I am just curious about the philosophy within SDIO as
1589 far as the type of people you want to attract, how long do
1590 you want to keep them and are you having difficulty, and if
1591 you could, if you have a personnel manager or someone over
1592 there, would you furnish that to us?

1593 General MONAHAN. I would be very happy to do so. I will
1594 be able to give you more.

1595 [The information follows:]

1596

1597 ***** COMMITTEE INSERT *****

INSERT FOR THE RECORD

HOUSE		APPROPRIATIONS COMMITTEE	☒ HOUSE	ARMED SERVICES COMMITTEE	HOUSE	OTHER
SENATE			SENATE		SENATE	
HEARING DATE 14 MARCH 1989		TRANSCRIPT PAGE NO. 66	LINE NO. 1594		INSERT NO.	

QUESTION: DARPA, for instance, testified a few weeks ago that they actually have a policy of having turnovers. Again, I am curious about the philosophy within SDIO as far as the type of people you want to attract, how long do you want to keep them and are you having difficulty, and if you could, if you a personnel manager or someone over there, would you furnish that to us.

ANSWER: SDIO has no formal policy established on having turnovers. Our turnover rate, I feel is low, and is generally caused by the routine turnover of the military officers and enlisted personnel currently assigned to SDIO. Our civilian workforce, in my opinion, is very stable. Our secretarial workforce is our largest area of turnovers and is typical of the clerical workforce in the Federal Government today.

We seek highly specialized individuals, be it military or civilian personnel. This is primarily a direct result of the mission of the SDIO. Due to the extensive research and development required to have an Strategic Defense, we must attract individuals whose background is extensively involved with the various technologies that we require, i.e. DEW.

The SDIO has a Chief of Staff whose responsibility includes the manpower, personnel issue. In addition, we have a Resource Management Directorate which includes a Human Resources Division. Our personnel office serves as liaison personnel office, not an operating one, and we receive support in these areas from Washington Headquarters Services.

1598 General MONAHAN. I will tell you this, I want to attract
1599 the very best people we can. I think we have been fortunate
1600 because the nature of the program is a real magnet and I
1601 would like to keep them just as long as we possibly can. We
1602 might move them around within the organization--

1603 Mr. MCCURDY. Has SDIO taken the approach, say, of DARPA,
1604 as opposed to strictly program managing or programs such as
1605 the F-16, where you have actual large numbers of people?
1606 Are you more just managers just going out and saying,
1607 "Well, here's the areas we want to go contract in. We let
1608 contract and we supervise those contracts." Is there a
1609 difference in philosophy--

1610 General MONAHAN. There is ~~a~~ within our organization right
1611 ~~within the Pentagon, in the SDIO itself~~, there is a mix of
1612 management-type people and scientific and engineering
1613 people. We are just the tip of the iceberg. Right now, we
1614 estimate 30- to 33,000 people in this country are working on
1615 the SDI program.

1616 In fact, I have some additional data about that. I would
1617 be happy to provide it to you, but we are just the start.
1618 You know, an awful lot of the work we do is performed by the
1619 Army and the Air Force, some by the Navy, DARPA, Department
1620 of Energy, et cetera. We get just excellent work from the
1621 national laboratories under the Department of Energy.

1622 Then we do a fair amount of it ourselves. Obviously, the

1623 responsibility to integrate all of those various elements
1624 that I briefed you on--that can rest nowhere other than
1625 within the SDI organization itself, so because of that, we
1626 need managers, scientists and engineers.

1627 Mr. MCCURDY. That is why I am interested in your delta
1628 there, the percentage of change, where you have had--

1629 General MONAHAN. Okay, we will try to get that
1630 information for you.

1631 Mr. MCCURDY. Let's focus on cost for just a minute. I
1632 was fascinated by the chart in your briefing that shows the
1633 curve coming down on the cost. I only wish we had other
1634 program managers who came before us on this committee with
1635 similar experience. Most every program we have had thus far
1636 has actually had a learning curve going the other direction.

1637 Maybe we ought to take these 260 people and put them
1638 elsewhere in the department because the--I don't care if it
1639 is a system that I strongly supported, such as the C-17,
1640 which seems to have some cost growth, which is just a
1641 transport, or whether it is an ATF or an ATA or just even
1642 simple missile systems--that is on page 27, I finally found
1643 it.

1644 The cost you indicate from 1988, from the DAB review
1645 there, to--from June 1988 to September 1988--you are
1646 forecasting, because of technology developments, a reduction
1647 of some \$40 billion and your cost goal is the further

1648 reduction of almost another 15 to 20 billion. How are you
1649 able to accomplish this?

1650 General MONAHAN. Okay. Let me take the first part of how
1651 it came down here to the 69 billion from what it had been
1652 before. Technology development was part of it; another part
1653 of it was de-scoping ^{just} a good portion of the program, not ~~as~~
1654 many of the interceptors. Recall that phase 1 is built to
1655 fulfill a JCS requirement. The requirement is classified,
1656 but nevertheless, it is designed to do that. They found
1657 they didn't need quite as much in the way of fielded
1658 hardware to fulfill that requirement and that is one of the
1659 major reasons why it was reduced down to 69 ^{billion}.

1660 There also was--because the technology is moving kind of
1661 fast--a determination that certain of the hardware could
1662 really do more than originally planned. So that is how it
1663 got down there to the 69 billion.

1664 Mr. MCCURDY. So it is not technology development, per se,
1665 it is a change in the requirements.

1666 General MONAHAN. It is both. It is both.

1667 Mr. MCCURDY. Tell me a little more about the technology
1668 development. You told me about the change in requirements.
1669 What significant breakthrough has there been that allows
1670 that cost reduction?

1671 General MONAHAN. I don't know that there was a real
1672 significant breakthrough. Let me just check.

1673 Okay. Certain functions that were duplicated on certain
1674 elements of the program, ~~they didn't~~ they removed the
1675 duplication. For example, certain things that SBI was
1676 doing, the SSTS was already doing. They took some of that
1677 function away from the SBI; therefore, brought that ^{cost} down. I
1678 don't think you can call that technology development, so I
1679 don't think I answered your question yet. We need to take
1680 that for the record.

1681 Mr. MCCURDY. I would be interested to see that.

1682 [The information follows:]

1683

1684 ***** COMMITTEE INSERT *****

INSERT FOR THE RECORD

HOUSE	APPROPRIATIONS COMMITTEE	☒	HOUSE	ARMED SERVICES COMMITTEE	HOUSE	OTHER
SENATE			SENATE		SENATE	
HEARING DATE		TRANSCRIPT PAGE NO.		LINE NO.	INSERT NO.	
3/14/89		70		1680		

Enclosed is Lt Gen Monahan's testimony
 Legislation and National Security, Com
 Attached to the testimony is an SDIO in
 detailed discussion on the reasons for th
 June 1988 (\$115B-88) to October 1988



STATEMENT ON

THE STRATEGIC DEFENSE INITIATIVE

BY

LIEUTENANT GENERAL GEORGE L. MONAHAN
DIRECTOR

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

BEFORE THE

SUBCOMMITTEE ON LEGISLATION AND NATIONAL SECURITY
COMMITTEE ON GOVERNMENT OPERATIONS
HOUSE OF REPRESENTATIVES

101st CONGRESS, FIRST SESSION

MARCH 21, 1989

Mr. Chairman, your letter of invitation asked me to testify before the Subcommittee on Legislation and National Security, on the subject of cost estimating methodologies and the basis for the cost estimates for the potential Phase One Strategic Defense System (SDS).

Cost reduction has long been recognized as an important component of the SDI program, and cost-reduction efforts have been emphasized in tandem with technology research. By anticipating potential SDS costs, and by implementing technology development strategies that focus on reducing costs, we believe we are focusing directly on one of the key issues of SDI, affordability. As Lieutenant General Abrahamson testified last October to the joint committees on Armed Services, the current estimate of the total cost to demonstrate, validate, develop, produce and deploy the first phase of an SDS is \$69 billion in constant FY 1988 dollars (B-88). This figure is a substantial cost reduction from the \$115 B-88 estimate of June 1988, and we expect even further reductions as architecture refinements and other improvements are made. The reduction to \$69 B-88 was achieved largely through eliminating unnecessary redundancy from the SDS architecture and operational concept, increasing space-based interceptor performance, and reallocating interceptors from space to ground.

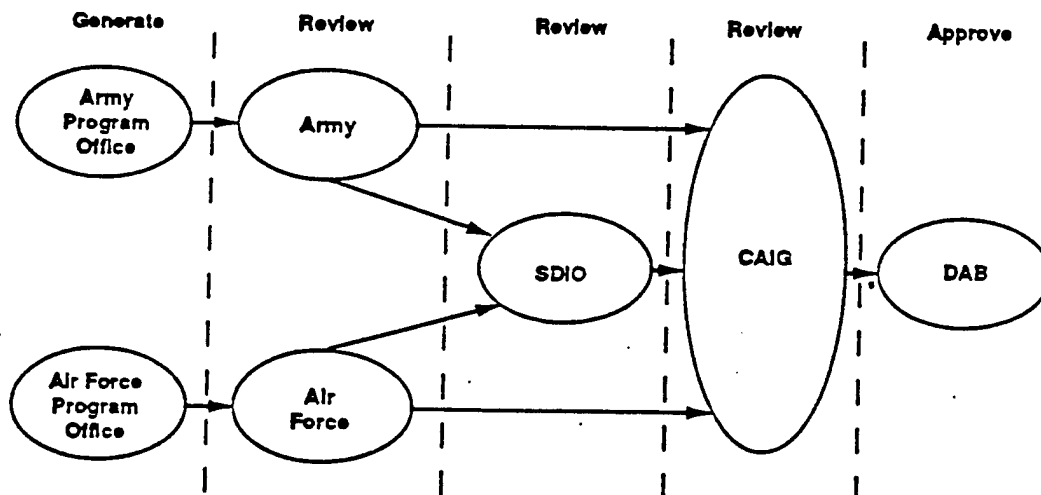
I think it is important to note that the majority of our cost estimates are the product of current Army and Air Force cost estimating methods and processes used for all weapon systems.

These Service cost analyses are based on the actual cost histories of existing systems and projections of the impacts of new technologies and processes. Chart 1 illustrates the process by which the \$69 B-88 cost estimate was reached. A final review is conducted by the Cost Analysis Improvement Group (CAIG), before presentation to the Defense Acquisition Board.



Chart 1

THE SDS COSTING PROCESS



I have attached to my statement an unclassified information paper detailing how SDIO arrived at the \$69 B-88 cost estimate. I think you will agree with our conclusion that the cost reduction achieved last year was a result of finding a better way to do the job, not simply "improving" the cost analysis procedures.

SDIO will continue to sponsor research that will aim at reducing both the costs of systems due to performance requirements and the costs of systems due to administrative and regulatory requirements, and continue to emphasize the importance of how much a system "could cost." Our goals are a properly balanced architecture that allocates functions in the most economical way, and an industry that efficiently adds value to its products using the most appropriate technology and capital base. SDIO will continue to set challenging cost objectives, and will continue intensive efforts at cost reduction.

While we have estimated the cost of Phase I to be \$69 B-88, we are reviewing alternative architectures and technologies that could result in the cost estimate being substantially reduced from \$69 B-88. Phase I has just entered the Demonstration and Validation phase; it is at a very early stage in the acquisition process and cost estimates can change. We anticipate achieving cost goals and bringing the total cost of Phase I below \$69 B-88.

I am prepared to address your questions.



- Information Paper -

**STRATEGIC DEFENSE SYSTEM
COST REDUCTION
June 1988 to October 1988**

March 21, 1989

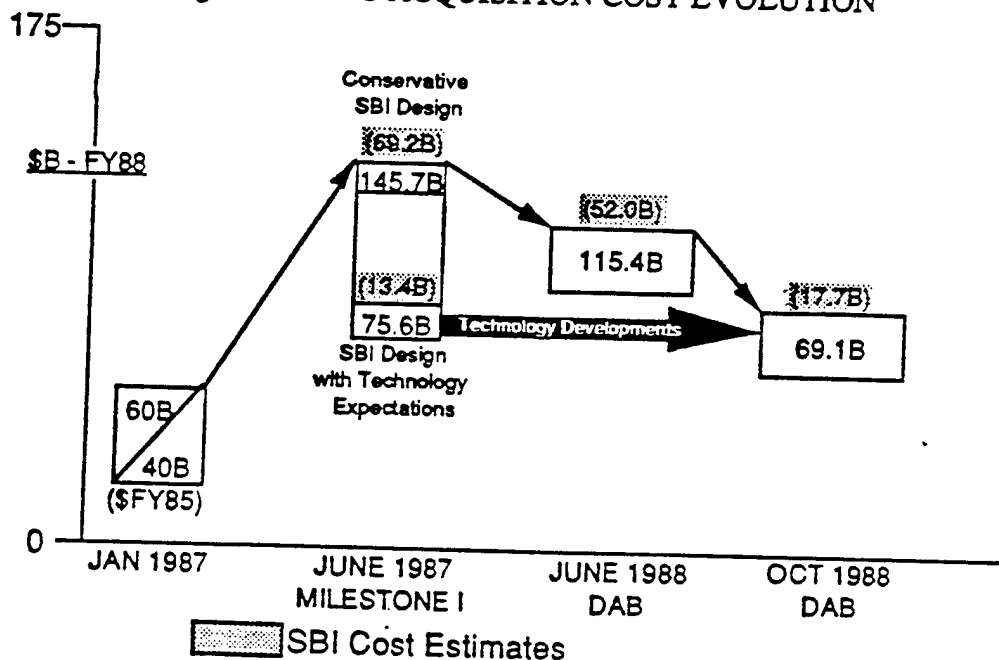
Phase I of the Strategic Defense System is currently in the Demonstration/Validation phase of system acquisition. As such, it is undergoing research, development and testing aimed at developing an optimal system to enter Full Scale Development. SDS Phase I is a "system of systems" in that its major elements (see following) are systems in their own right. The overall costs of SDS Phase I depends on the functions assigned to each of these elements, the degree to which these functions must be assigned to more than one element to bolster confidence, and the projected availability of key technologies. In the process of developing SDS Phase I, significant improvements have been realized in the cost to perform its mission. This paper discusses those improvements.

I. INTRODUCTION

The latest official DoD (SDIO, Army and Air Force) estimates for the acquisition of the initial phase (Phase I) of the Strategic Defense System (SDS) saw significant refinements and reductions between June and October 1988, dropping from \$115 billion to \$69 billion in Fiscal 1988 dollars. This resulted from reallocating functions, earlier realization of technology expectations, removing excess performance and continued refinement of the system definition. These reductions were accomplished while maintaining the ability of the system to satisfy its mission requirements and without major changes to cost estimating methods.

The evolution of acquisition cost estimates from the initial cost projections in January 1987 through the Defense Acquisition Board (DAB) Milestone I review and subsequent update reviews is depicted in Figure I-1. The original January 1987 estimates were based on an architecture that was designed for production of a strategic defense system as soon as possible. At Milestone I, as the Joint Chiefs of Staff requirements were established, the costs reflected a more robust architecture to meet those requirements. Note that uncertainties in architecture design requirements at that time resulted in a range of costs corresponding to a range of technical options.

Figure I-1. SDS ACQUISITION COST EVOLUTION



The October 1988 estimate reflected a more mature design and updated technology projections than were used for the June 1988 estimate. The October estimate also reflects more emphasis on ground-based weapons for the initial deployment. The cost of the Space-Based Interceptor (SBI) element is highlighted in this chart because of the dramatic change in its acquisition estimate. From June to October, Space-Based Interceptor (SBI) weapons constellation size decreased by 51% while ground-based Exoatmospheric Reentry Vehicle Interceptor Subsystem (ERIS) weapons increased by 70%. These quantity changes incorporate improved SBI performance and survivability measures, and reduce architecture performance that was previously above the Joint Chiefs of Staff requirements for the Strategic Defense System Phase I. Nevertheless, these tradeoffs were made not only on the basis of reducing costs. The robustness of the mix of SBI and ERIS elements to countermeasure alternatives was an important factor in the October 1988 estimate.

The remaining discussion will present: an overview of cost analysis and estimation techniques used, reasons for the changes in cost, details of the cost reductions, a discussion of system performance, and conclude with SDIO's plans for continuing cost reduction and attainment of cost goals.

II. COST ANALYSIS

In order to put the cost reduction effort in perspective, an understanding of some basics of cost analysis is required. The 1988 service cost estimates are the product of current Army and Air Force cost estimating methods and processes used for all weapon systems. These Service cost analysis systems are based on the actual cost histories of existing systems and projections of the impacts of new technologies and processes. Further, assessments have been made by all levels of the Service command structures in order to determine whether the work described can be performed within the estimate. The cost reduction observed between June and October of last year was a result of finding a better way to do the job, not by simply "improving" the cost analysis procedures.

Cost estimates are developed in dollars for a given "base year", normally the same fiscal year in which the estimates are generated, representing what a system would cost "today." In actuality, the costs are distributed throughout the life of the system acquisition. Projected inflation rates by year can be applied to the constant year estimates to obtain an escalated estimate, but this estimate would over emphasize later costs (e.g., in production) and not be comparable to the costs of systems acquired in different timeframes.

Cost estimate development uses a combination of three cost estimating methodologies: parametric, analogy, and engineering build-up. Parametric methodology involves the use of Cost Estimating Relationships (CERs) which relate a selected design or performance parameter (e.g., weight, power) and an item's cost. Analogy estimating derives a cost from data on an existing system based on engineering judgement of the effects of complexity, technical, or physical differences. Engineering build-up is applied to items where estimates are attainable at the lowest functional level of detail (e.g., direct labor, tooling, materials).

Design, performance or other technical characteristics that best describe a system are selected to estimate costs and are termed "cost drivers". History and logic have shown that the cost of a system varies in relation to the value of these characteristics. There are many cost drivers, but those that cause the majority of near-term changes in system cost fall into three primary categories: size, complexity and technology.

Size is the most dependable of the three; when other aspects are the same (parts density, manufacturing complexity, product technology, etc.), then the size of an item will directly relate to its cost: bigger houses cost more; 10 pounds of hay costs more than 5 pounds. However, the relationship between cost and size is not necessarily linear. "Economies of scale" can occur which result in the cost-per-unit-size of larger items to be less than that for smaller (the "large economy size" phenomena). Size increases often result in proportionally lower cost increases.

The impact of complexity is illustrated by the comparison of satellite mechanical structure to satellite communication equipment. Satellite structure involves few pieces but is the result of a complex design and production process because it must be as light as possible and adapt to wide ranges of temperature. The complexity of the communication equipment far exceeds that of the structures. The communication equipment material must meet the same weight and temperature requirements as the structure, and be built so that its many parts and connections operate for long periods of time. Products are split into similar complexity level groups for analysis. Therefore, estimating relationships developed for structures yield lower costs than those for communication equipment for like sizes.

The goal of technology development is often to reduce the cost of a function or product. The control of technology and the anticipation of the impact of new technology on system costs are major problems facing our acquisition system today. Available, simplifying technologies bring costs down, while rare and enabling technologies may drive costs up. This requires that the mix of technology in a product be carefully tracked when developing a cost estimate. The SBI Focal Plane Array (FPA) is an example of a technology that is expected to make the transition from expensive to cheap, and the consequent possibility of replacing a scanning array with a staring array is one of the reasons that the estimated costs of SBI could be reduced so dramatically.

In the past, costs of individual units have been observed to decrease in a somewhat predictable manner as the quantity increased. These reductions are attributable to job familiarization by workers performing repetitious tasks, general improvement in tool design and utilization, production control improvements, reduced scrap, improved materials flow, and other factors. "Learning curves" are non-linear equations that are applied to almost all production cost estimates, especially where the units involved justified planning and tooling activities over those used to produce a development, or prototype, unit. The "learning" concept's importance to this discussion is enhanced by the fact that several of the cost increases and decreases of the Phase I elements were directly related to quantity increases and decreases. The non-linearity of learning; however, precludes a one-to-one comparison of the cost change to the quantity change (i.e., a 50% reduction in quantity equates to a less than 50% reduction in cost).

The above discussion provides a brief summary of the analytical issues which are addressed in the cost analysis of modern defense systems. It does not provide a comprehensive review of the topic, but should be of assistance in understanding the cost changes discussed in the following section.

III. COST REDUCTIONS

Overall the acquisition costs for Phase I SDS between June 1988 and October 1988 declined 40% (Table III-1). Only three of the nine elements had modest cost estimate increases (ERIS, GBR, Launch), while four had major decreases. Of these elements, the one with the most dramatic reduction was the SBI going from \$52 billion in June to \$17.7 billion in October, a decrease of 66%. It is important to note that a performance reserve is allocated to allow for additional capability expansions if required to meet a changing threat, and that the management reserve ("Cost Reserves") imbedded in the estimate exceeds 10% for both Development and Production phases. This reserve is a key part of stabilizing costs in a changing technology and threat environment.

TABLE III-1. ACQUISITION COST REDUCTIONS (FY88\$ IN BILLIONS)

Element	Jun DAB	Service Briefs (Oct 88)	\$ Reduction	% Reduction
BSTS - Boost Surveillance and Tracking System	9.0	8.0	(1.0)	(11%)
SSTS - Space-Based Surveillance and Tracking System	12.6	9.2	(3.4)	(27%)
GSTS - Ground-Based Surveillance and Tracking Systems	3.6	3.3	(.3)	(8%)
SBI - Space-Based Interceptor	52.0	17.7	(34.3)	(66%)
ERIS - Exoatmospheric Reentry Vehicle Interceptor System	4.8	5.8	+1.0	+21%
BM/C3 - Battle Management/Command, Control and Communication System	14.6	7.3*	(7.3)	(50%)
GBR - Ground Based Radar	2.7	3.1	+.4	+15%
SE & I - System Engineering and Integration	7.8	5.0*	(2.8)	(36%)
LAUNCH	8.3	8.6*	+.3	+4%
Cost Reserves (Imbedded)	—	[7.6]	+1.1	—
Performance Reserves	—	1.1		
TOTAL	115.4	\$69.1	(46.3)	(40%)
* SDIO ESTIMATES		[] NON ADD		

A major factor behind the cost reductions was the evolutionary elimination of redundancy from the SDS architecture and operational concept. An extensive architectural analysis highlighted areas in which overlaps in functions existed unnecessarily between individual elements. Although pre-planned redundancy is a legitimate instrument for reducing risk or increasing survivability, the existence of unplanned redundancy can

increase costs without helping risk or survivability. The other factors behind the cost reductions were technological advances and architectural improvements. Minor changes in cost estimating methodologies were made only in the rare cases where new reference data was available. Table III-2 lists the changes in primary technical cost drivers from June to October as a percentage of the June baseline. Changes in cost relate to the changes in these cost drivers. This can be seen in the following discussion of Phase I elements.

The most substantial portion of the overall SDS cost reduction was due to the 66% reduction in SBI, which was achieved through a combination of several factors:

Communications/Processing: The amount of SBI Communications/Processing equipment has been decreasing. Initially, Communications/Processing in SBI was reduced as technology development allowed more specific selection of components (June 1988 case), and then the BM/C3 function was removed since it was redundant to that on the SSTS. This significant reduction in weight generates a significant reduction in the cost of the current SBI system.

Infrared Sensor: This equipment provided the fire control capability for initial high-cost cases. The June 1988 version of the SBI carrier vehicle had sensor, laser gimbal and structure hardware to perform this function. Further, this equipment increased power, thermal control, structure, reaction control and propulsion requirements of the basic carrier vehicle. By removing the fire control function from the carrier vehicle, the cost of the equipment and the cost of accommodating it was saved. The reduced complexity of the satellite greatly reduces development risk as well.

Quantities: The reduction in quantity of interceptors and carrier vehicles in the current SBI concept significantly reduces the recurring production cost of the SBI element. For example, by reducing the total production quantity by 53%, the recurring production cost for the constellation can be reduced by 49% even if no other changes take place due to simple learning effects.

Carrier Vehicle Weight: This parameter refers to the weight of the carrier vehicle without interceptors, communications, processing or other payloads. Although the weight of the June 1988 and October 1988 designs are nearly the same, the composition changed. The current carrier vehicle has fewer expensive components and more inexpensive components. Elimination of redundancies warranted the removal of the fire control sensor and the BM/C³ functions. These payload deletions along with their associated equipment have reduced requirements on every carrier vehicle subsystem and significantly reduced program risk.

Interceptor: A key SBI driver is the focal plane array (FPA). We are now working toward an improved technology that will be more producible and affordable based on results from recent laboratory accomplishments. The key to these advances is the ability to produce "chips" of the proper material in the proper configuration. These chips improve performance so that a lighter projectile can be produced. The lighter projectile makes it feasible to resize the rocket motors, and thus increase the velocity, range and effectiveness of the interceptor. The increase in motor weight is an extra load on the carrier vehicle structure, but these are very inexpensive components on a weight basis compared to the rest of the system. The estimated cost of the FPA is based on history and progress in technology development.

High Rate Production: The SBI carrier vehicle will be the first satellite to be produced in numbers comparable to aircraft or weapon system production. The simplification of the satellite has reduced the risk of unforeseen problems during the development phase, and it enables us to plan a more economical production program as well.

TABLE III-2. PRIMARY SDS PHASE I COST DRIVER CHANGES

PARAMETER	% OF JUNE BASELINE	CHANGE RATIONALE
SBI \$52.0 B (88) → \$17.7B (88)		
FIRE CONTROL SENSOR	0%	• REDUNDANT TO OTHER SENSORS
INTERCEPTOR WEIGHTS • PROJECTILE • MOTOR STAGES	59% 315%	• ENABLES VELOCITY INCREASE/COSTLY • FOR VELOCITY/INEXPENSIVE
INTERCEPTOR APERTURE	70%	• FOCAL PLANE ARRAY TRADE
CARRIER VEHICLE WEIGHT • DRY (NO PROPELLANTS) • TOTAL	92% 97%	• HEAVIER INTERCEPTOR PAYLOAD, BUT LESS COMPLEX
COMMUNICATIONS/ PROCESSING WEIGHT	30%	• BM/C3 REDUNDANT TO SSTS
ELECTRICAL POWER	25%	• EQUIPMENT REDUCTIONS
QUANTITIES • CONSTELLATION • PRODUCTION	49% 47%	• WEAPON REALLOCATION • IMPROVED PERFORMANCE • REDUCED PRODUCTION RISK
SSTS \$12.6B (88) → \$9.2B (88)		
APERTURE	50%	• MISSION REDUCTION • MANAGE SENSOR REDUNDANCY
DETECTORS	10%	• REDUCED APERTURE • MISSION REDUCTION
SIGNAL PROCESSING	13%	• REDUCED DETECTORS
DATA PROCESSING	23%	• REDUCED DETECTORS
ELECTRICAL POWER	43%	• EQUIPMENT REDUCTIONS
SATELLITE WEIGHT • DRY (NO PROPELLANTS) • TOTAL	53% 87%	• INCLUDES NEW INTEGRAL STAGE • ORBIT INSERTION PROPELLANT
QUANTITIES • CONSTELLATION • PRODUCTION	150% 157%	• COMMUNICATIONS DRIVEN
BSTS \$9.2B (88) → \$8.0B (88)		
QUANTITIES • CONSTELLATION • PRODUCTION	75% 80%	• REDUNDANT SENSOR CAPABILITY
ERIS \$4.8B (88) → \$5.8B (88)		
QUANTITIES • DEPLOYED • PRODUCED	170% 163%	• WEAPON REALLOCATION • REDUCED RISK

Several new technologies have been used to improve the SBI, ranging from improved propulsion to enhanced seeker focal plane materials. However, none of these advances has been achieved spontaneously. They are the result of parallel advanced technology programs that have been seeking better capabilities at lower cost for several years. Current SBI designs take advantage of expected technology developments in which we have high confidence. We anticipate that, as they mature, these and several other technology developments will continue to provide performance augmentation options for the system elements.

The SSTS acquisition cost decreased from \$12.6 billion to \$9.2 billion. This resulted from the combination of a significant decrease in individual satellite capability and cost, and a relatively smaller increase in constellation size. The net effect is a less expensive system which continues to support architecture sensing and coverage requirements. As with SBI, the opportunity for a reduction in the SSTS sensing capability occurred because of redundancy within the overall architecture. The combined sensing capabilities of GSTS and GBR, as well as the sensor on the ERIS interceptor, allowed reductions in SSTS capabilities without compromising SDS effectiveness. The scaleback of SSTS was accomplished by a 50% reduction in aperture size and the elimination of 90% of the number of the detectors, allowing corresponding reductions in satellite structure, processing, and other subsystems. This combination of effects resulted in the significant decrease in SSTS costs.

BSTS's acquisition cost decreased from \$9.0 billion to \$8.0 billion between the June and October estimates. The cost reduction resulted from a reduction in constellation size and a technical reassessment of the FPA as described earlier for SBI interceptor cost impacts. Although the change has decreased the sensing capability of the BSTS constellation, the reduction did not lead to a decrease in military effectiveness. Analysis of previous architecture concepts showed there was an excess of sensing capability relative to weapon capability -- the sensors could acquire more information than required. The removal of this "excess" sensing capability reduced costs without a corresponding degradation in overall system effectiveness.

The cost of the ground-based ERIS increased from \$4.8 billion to \$5.8 billion between June and October, because of a decision to utilize more ground-based interceptors. The increased capability of the space-based interceptors allowed its numbers to be reduced even further than the compensating quantity increase in ERIS without impacting the SDS mission. The increased ERIS cost is due to a 70% increase in interceptor inventory along with parallel increases in launchers, support facilities and personnel. Due to the large amount of non-recurring cost in the estimate, which is independent of quantity, this equates to only a 21% increase in total acquisition cost.

A second SDS element to experience a slight cost increase between the June and October DAB reviews was GBR. The increase, from \$2.7 billion to \$3.1 billion, resulted from minor programmatic changes relating to schedule, and new cost data received from the contractor for the experimental version of the radar (resulting from the pending expansion of GBR from a terminal only sensor to a midcourse/terminal sensor.) GBR is not currently approved as an element of Phase I. It is under consideration and included here for architecture analysis purposes.

GSTS did not experience any significant technical or programmatic changes. The cost of GSTS declined slightly from \$3.6 billion to \$3.3 billion, due to a reduction of flight testing in favor of more ground testing and a reduction in the effort to be provided by a second source contractor.

In the BM/C3 area, major changes in the operational concept and hardware definition resulted in a 50% acquisition cost reduction. The key modifications were: change in the size and acquisition strategy for obtaining a dedicated SDS fiber optics network; a reduction in the estimated real-time software requirements; elimination of an Airborne Command Center (ACC) component; and, utilization of a larger number of existing ground segment command centers.

The Systems Engineering & Integration (SE&I) acquisition costs were reduced by 36% due to significant changes in the functions of the SE&I segment. These included a reduction of overlapping integration and test software development efforts, a reduction in centralized integration facilities and hardware (versus distributed facilities to the elements), elimination of centralized training and training software development, and the elimination of the requirement for centralized integration and simulation hardware.

1685 Mr. MCCURDY. And, of course, your cost is now 50 to 55
1686 billion. There were reports yesterday of a letter from
1687 General Abrahamson to someone that was on the news last
1688 night that indicated that he felt--I don't know--that a \$25
1689 billion system was in order. Is that an accurate
1690 description of such letter?

1691 General MONAHAN. I believe he did say that, in the paper
1692 that I read.

1693 Mr. MCCURDY. To whom was the letter written?

1694 General MONAHAN. What you are quoting from is his end-of-
1695 tour report that he sent to the Deputy Secretary of Defense.

1696 Mr. MCCURDY. Was it a classified document?

1697 General MONAHAN. I don't believe so.

1698 Mr. MCCURDY. Oh, here it is. Trusting staff always has
1699 everything.

1700 What he says is, ''Adding BSTS to the system as a
1701 replacement for DSP and a redundant warning capability along
1702 with the required command and control capability would add
1703 15 billion, for a total of research development and
1704 deployment costs for approximately \$25 billion.'' Is he
1705 just talking about Brilliant Pebbles?

1706 General MONAHAN. I think I would have to reread exactly
1707 what it was he said because I read that--the end-of-tour
1708 report, a few weeks ago. First of all, he is talking about
1709 Brilliant Pebbles, but then he is talking about other sensor

1710 and command and control elements that would have to go along
1711 with that. I think he is including the BSTS, for example,
1712 although I can't recall for sure.

1713 Mr. MCCURDY. So when--

1714 Mr. KYL. Excuse me, if the gentleman would yield, I think
1715 I can shed some light on that.

1716 He has two total costs. First of all is the cost of the
1717 phase 1 system that would include a space-based component.
1718 That is 25 billion, comprised of three things: \$10 billion,
1719 approximately, for the Brilliant Pebbles component; \$11
1720 billion for the surveillance satellite and
1721 telecommunications portion of it; and \$4 billion for the
1722 support structure ground command and control. That total is
1723 25 billion.

1724 Then, for the ground-based portion of that, with which you
1725 are familiar, there is an additional 25- to 30 billion, for
1726 a total of 50 to 55 billion.

1727 Mr. MCCURDY. So he is basically saying that your numbers,
1728 50 to 55, as a cost goal for a SDS system is consistent with
1729 what this letter is. This is no new revelation then? He is
1730 saying it is a total system of 50 to 55, or is he saying,
1731 no, he disagrees with your 50 to 55 number and saying it
1732 could really be for 25? I am confused here.

1733 General MONAHAN. I really don't know the answer to that,
1734 either, Mr. McCurdy.

1735 Mr. MCCURDY. Does the gentleman from Arizona know?

1736 Mr. KYL. It is just a matter of two components. In his
1737 letter, he describes the space-based component, with all of
1738 its bells and whistles, would be 25. Then add the ground-
1739 based component for another 25 to 30. Add them together;
1740 you have the total of 50 to 55.

1741 Mr. MCCURDY. So the reports on the news last night were
1742 somewhat exaggerated, which is not unusual, but--in saying
1743 that they really felt that it could be done for 25, which
1744 seems to be--for a total system would be unrealistic. I
1745 mean, you have no knowledge whatsoever of a total phase 1
1746 system that could be built for 25 billion, right?

1747 General MONAHAN. Phase 1 system, as it is laid out here,
1748 clearly could not.

1749 Mr. MCCURDY. What is your best guesstimate of the phase 1
1750 cost?

1751 General MONAHAN. Sixty-nine as of the moment. As we
1752 press forward and try to do better in the research arena--one
1753 of our major goals in the program is to get the cost down.
1754 I don't know how low we can get it, but--

1755 Mr. MCCURDY. Can you give me the figures on the BSTS,
1756 what your best figure is for just that portion of it? Is
1757 that consistent--

1758 General MONAHAN. For the BSTS part of the program? In
1759 1988 dollars, it is a total of 8 billion and that is

1760 research, development, acquisition costs.

1761 Mr. MCCURDY. Eight billion? How many deployed, and
1762 again, interrupt me if I get into an area we need to discuss
1763 in--

1764 General MONAHAN. It is six BSTS deployed.

1765 Mr. MCCURDY. And this is a multispectral system and all
1766 the bells and whistles?

1767 Mr. DELLUMS. Would the gentleman yield just for one quick
1768 second?

1769 General, would this BSTS provide battle management
1770 capability, and if so, would that capability then make this
1771 nontreaty-compliant?

1772 General MONAHAN. BSTS perhaps could. We haven't arrived
1773 at all those decisions yet. We are still on the
1774 demonstration/validation phase, so the final spec isn't
1775 written.

1776 Mr. DELLUMS. I thank the gentleman for yielding.

1777 Mr. MCCURDY. Certainly.

1778 Again, I have to be careful here, but I am somewhat
1779 concerned. I have two other committee assignments. One is
1780 the Science and Space Committee and the other is the
1781 Intelligence Committee. Having some knowledge of satellites
1782 systems and the cost of those, at least from the cost
1783 standpoint that we are always being presented with, I find a
1784 rather ambitious undertaking for a total system with that

1785 capability within those costs.

1786 Are you telling me that this is again some technology
1787 breakthrough or--

1788 General MONAHAN. No.

1789 Mr. MCCURDY. Perhaps at some stage, we could go into a
1790 classified arena and you could show us in a little more
1791 detail what you--how you are going to pull this off.

1792 General MONAHAN. Right. I think, Mr. McCurdy--

1793 Mr. MCCURDY. I mean, launch costs alone are running in
1794 the hundreds of millions of dollars these days.

1795 General MONAHAN. Certainly. Satellites--average cost is
1796 about \$20,000 a pound, historically. Except GPS, I think we
1797 got it down to 10,000 because we finally bought a bunch in a
1798 roll.

1799 I feel good with the \$69 billion estimate. Why? Because
1800 it was developed from the bottom up. It came from the
1801 people who are going to develop it to begin with. So it
1802 came from the Army and the Air Force and the other elements,
1803 the other--our other agents. That is the first thing.

1804 The second thing is it was subjected to an independent
1805 review conducted by the SDI ^{Organization} Office and then another
1806 independent review by the cost analysis group in the
1807 Pentagon. So it went through the formal rigorous cost-
1808 estimating procedure and then went through all the various
1809 checks associated with it.

1810 I don't know how you--

1811 Mr. MCCURDY. What year dollars are you using?

1812 General MONAHAN. Those are fiscal year 1988.

1813 Mr. MCCURDY. In the January 23rd issue of Aviation Week,

1814 officials--Grumman said that BSTS would cost roughly 30

1815 billion over several decades. Is that--

1816 General MONAHAN. Thirty billion over several decades?

1817 Mr. MCCURDY. Yes.

1818 General MONAHAN. Okay.

1819 Mr. MCCURDY. Life-cycle versus--you know, you guys come up

1820 here and you give us 1988 dollars versus 1990 and--I don't

1821 know the numbers here.

1822 General MONAHAN. I gave you--what I gave you there for

1823 BSTS were the costs to do phase 1, phase 1 on the program,

1824 which is the first six BSTSs. If you are going to keep BSTS

1825 going another 50 years, obviously you will spend a lot more

1826 money.

1827 Mr. MCCURDY. So you are saying an initial deployment of a

1828 complete system, even though it is not life-cycle--long-term,

1829 would be, what, number six to nine?

1830 General MONAHAN. Eight billion dollars for the first six

1831 BSTS systems and that does not include operating and support

1832 costs and does not include anything beyond those first

1833 systems. I believe the number six is correct.

1834 Mr. MCCURDY. That is both ground and--

1835 General MONAHAN. It buys three spares, so that is a total
1836 of nine--

1837 General MONAHAN. --support systems for--

1838 General MONAHAN. Yes. It is, right.

1839 Mr. MCCURDY. We would like to see some specific breakdown
1840 for that.

1841 Just one last question. On your strategic review that is
1842 ongoing, the--as of this stage, there has not been a decision
1843 on a ALPS versus a phase 1--I mean, you still maintain that
1844 phase 1 is your deployment scenario that you prefer. Is
1845 there discussions within the strategic review or have you
1846 been tasked by whoever is in charge over there right now to
1847 come forward with an ALPS review?

1848 General MONAHAN. Some of the options that we have under
1849 consideration in the strategic review do include ALPS as
1850 part of it.

1851 Mr. MCCURDY. When will that review be forthcoming?

1852 General MONAHAN. I don't know what the final schedule is.
1853 I mentioned earlier I think within the Organization, we
1854 should have most of our work done this month. Then it has
1855 to go forward for further reviews.

1856 Mr. MCCURDY. Including budget numbers or have you already
1857 submitted those?

1858 General MONAHAN. No, we are working budget numbers at the
1859 same time.

1860 Mr. MCCURDY. Were you given a fair hearing, as they say?

1861 Are you exempt from all the Bush bogies?

1862 General MONAHAN. I don't know that I am exempt from
1863 anything, but I have not been given any bogies.

1864 Mr. MCCURDY. You specifically examined--I mean, when they
1865 said, "'DOD come up with a 2 percent reduction or
1866 whatever,'" SDI was exempt--

1867 General MONAHAN. We did not participate in that exercise,
1868 right.

1869 Mr. MCCURDY. Thank you.

1870 Thank you, Mr. Chairman.

1871 Mr. DELLUMS. The gentleman yields back his time.

1872 Mrs. Byron is recognized for such time as she may consume.

1873 Mrs. BYRON. Thank you, Mr. Chairman.

1874 General, let me follow along on the funding and the budget
1875 aspect, because over the last five years, you have been
1876 under-funded each year, although last year you came the
1877 closest to the requested funding.

1878 RPTS TETER

1879 DCMN TETER

1880 How long can you under-fund a system in a development
1881 stage and stretch it out again and again, barely, in some
1882 cases, keep the program alive, keep your technical team
1883 together, or is it not better to regroup, draw down, narrow
1884 the scope and operate within the funding levels that have
1885 been given you?

1886 General MONAHAN. I think if you keep having the wild
1887 swings all the time and you don't get the stability, before
1888 very long, people are probably going to start losing
1889 interest. An awful lot of the value that we get out of the
1890 program is--the American industry, noting that the United
1891 States Government has an interest somewhere and is willing
1892 to press on after a certain program, tends to put an awful
1893 lot of their own resources into it. We reap a benefit from
1894 that and it is kind of a benefit that we don't pay for, at
1895 least indirectly, so that is something that would be
1896 affected.

1897 Mrs. BYRON. I think I would be less than candid to say
1898 that the SDI program is somewhat battered. I look in the
1899 future, and I think that is one of the missions that this
1900 subcommittee has down the road, and I am looking for some
1901 vehicle that we can excite the younger generation to take
1902 the courses early on to get the advanced degrees, to put in

1903 the commitment to want to go to be a part of it.

1904 We saw that in the 1960s when many of you--I am sure your
1905 teen came home and said I want to be part of that group that
1906 is going to go to the moon. I don't see anybody coming home
1907 and saying, I want to be part of SDI when I grow up.

1908 At what point--and this follows on the chairman's comments
1909 and line of questioning--at what point do we have to make the
1910 decision to go nuclear or non-nuclear? I had asked this
1911 question previously about three or four years ago and the
1912 answer I got at that time was, oh, it is way down the road.
1913 Well, we are three or four years later and I envision a
1914 serious problem with a large number of members if you bring
1915 in that buzz word as part of the system.

1916 General MONAHAN. As I mentioned earlier, to do the entire
1917 phase 1 program, there is nothing nuclear that has to be
1918 done at all. Indeed, if you stay with the kinetic kill
1919 vehicles, both space-based and ground-based, there is no
1920 reason in the world to have anything nuclear associated with
1921 SDI. The possibility of nuclear occurs when considering
1922 space-based laser and ^{would} ~~would~~ a nuclear reactor be required to
1923 power a space-based laser.

1924 We don't know the answer to that yet, but that is a
1925 possibility. There was also, at one time, some notion that
1926 perhaps x-ray lasers, which would derive from a nuclear
1927 event, would be an effective directed-energy weapon in

1928 space. But ~~that~~ again, nobody really has to go there.

1929 So, other than that, as I said, the only time that you
1930 would be faced with such a decision is, first of all, if we,
1931 as a nation, decided we would put directed-energy weapons in
1932 space and decide to do that. Then we should know at about
1933 the same time whether or not nuclear power would be required
1934 for them.

1935 Mrs. BYRON. I have one final question and that is, it
1936 seems to me, looking at the battle that we have year in and
1937 year out on the ASAT program, it is going to be very
1938 difficult to get that step done. But it also seems to me to
1939 go from point A to point C, you have to stop off at point B
1940 and point B is ASAT. Would it not be more cost-effective to
1941 combine the two programs?

1942 General MONAHAN. No, I don't believe that it would, to
1943 tell you the truth. Obviously, both programs can probably
1944 use some bits and pieces from the other, but they really
1945 have quite different missions to perform.

1946 Mrs. BYRON. Thank you, Mr. Chairman.

1947 Mr. DELLUMS. The gentlewoman yields back the time.

1948 Mr. Weldon has returned and the Chair would like to
1949 provide the gentleman an opportunity to question and yields
1950 to the gentleman such time as he may consume.

1951 Mr. WELDON. I thank you, Mr. Chairman, for yielding and I
1952 apologize for having to leave. I have hearings going on at

1953 | three different committees at one time.

1954 | Just one line of comment and questions I want to pursue
1955 | was that relating to the ABM pre-discussions. As we all
1956 | know, any discussion of a treaty requires adherence on both
1957 | sides and one of my concerns is that while we were talking
1958 | extensively about SDI as a potential breakout for our
1959 | country on the ABM Treaty, that we, in fact, have
1960 | acknowledged on various occasions that the Soviets have
1961 | been, in fact, in violation of this same treaty in several
1962 | situations, not just with their own work and potential work
1963 | on SDI, which 10 years ago they were openly denying, and as
1964 | recently as five years ago, in discussions I have had in
1965 | Moscow, they were denying that they were doing any
1966 | Soviet--any work on SDI technology, yet our intelligence was
1967 | telling us something different by the photographs that we
1968 | have of laser generators and particle beam operations that
1969 | we had seen were being developed in their country.

1970 | Last week, Andre Kokoshyn testified before our Defense
1971 | Policy Panel and admitted that the Soviets have been, in
1972 | fact, exploring their own SDI as recently as six years ago,
1973 | but in his terms, they had given up on the technology, which
1974 | I find somewhat hard to believe. My point is that any
1975 | discussion of the ABM Treaty and the potential for SDI
1976 | operations to have us break out of that treaty has to also
1977 | be looked at in light of what the Soviets, in fact, are

1978 | doing along the same line.

1979 | One of the things that has bothered me is that I have
1980 | felt, in my two and a half years or two years plus three
1981 | months in Congress that we haven't always had access to the
1982 | full information about Soviet ABM compliance, as well as
1983 | potential for Soviet ABM breakout.

1984 | On last year's defense bill, I included a piece of
1985 | legislation that requires DOD to come up with a report, a
1986 | classified and unclassified report, on the potential for
1987 | Soviet ABM breakout. I would like to have you, if you
1988 | would, General, check into the status of that because I have
1989 | not received it yet, and I would also like to ask you, Mr.
1990 | Chairman, if you would, to consider holding a confidential
1991 | closed briefing for members of this subcommittee on what the
1992 | Soviets are doing in the area of SDI work. Using our latest
1993 | available intelligence, I had arranged a similar briefing in
1994 | the last session and had about seven members of the Armed
1995 | Services Committee sit through a briefing by defense
1996 | intelligence and Air Force intelligence. I think an updated
1997 | version of that would be useful to us as we consider SDI,
1998 | both from our standpoint and from the Soviets are doing in
1999 | this year's round of discussions and debate.

2000 | So I would ask you, Mr. Chairman, if you could arrange
2001 | the--

2002 | Mr. DELLUMS. If the gentleman would yield, the ranking

2003 minority member, Mr. Dickinson, already pursued this general
2004 line of questioning and we have informally agreed that we
2005 would create a forum that will allow this kind of classified
2006 information to come to all the members of the subcommittee,
2007 so we will deal with it.

2008 Mr. WELDON. I thank the chairman and I will yield back
2009 the rest of my time. Thank you.

2010 Mr. DELLUMS. The gentleman yields back his time.

2011 Does the gentleman from California, Mr. Hunter, seek
2012 recognition?

2013 Mr. HUNTER. Thank you, Mr. Chairman.

2014 Just a fast question and I thank you very much, Mr.
2015 Chairman, for allowing me to come in late in this hearing.
2016 I apologize. I, too, have a number of committees going.

2017 It appears to me that war-fighting scenarios in the way
2018 the world works and history works, that usually the truth is
2019 stranger than fiction and I recall a couple of years ago, we
2020 were looking over the possible conflicts in the world, where
2021 conflicts might appear, the Falkland Islands situation was
2022 the furthest from any of the perceived problems or expected
2023 problems, and yet, that is where we saw a major conflict.

2024 In the same sense, it appears to me that of the nations
2025 that are on their way to gaining ballistic missile
2026 capability, probably the one we are preparing most strongly
2027 against, the Soviet Union, is not as inclined, at least at

2028 | this time, to strike the United States as some other nations
2029 | are, may be or possibly will in the future.

2030 | I think it is very important that our SDI program fit the
2031 | threat, I guess is what I am saying. I just wondered,
2032 | General, how many nations are going to have ballistic
2033 | missile capability by, say, the year 2000? Do you have any
2034 | reading on that? Aside from the Soviet Union and China?

2035 | General MONAHAN. It is quite a few, Mr. Hunter. I don't
2036 | remember the number itself, but I can get it for you.

2037 | Mr. HUNTER. One thing that I am concerned about is that
2038 | we build a system, if we are going to, indeed, move ahead--I
2039 | think we should move ahead and we should build a system. I
2040 | think if you can't stop missiles, you can't defend your
2041 | country, but I think it is important that we build to the
2042 | threat and fit the threat.

2043 | I wonder if you could get for the record, with the
2044 | indulgence of the chairman, an analysis of the holders of
2045 | ballistic missile capability by the year 2000 and maybe
2046 | shortly beyond for this?

2047 | General MONAHAN. I would be happy to do so.

2048 | Mr. HUNTER. Is that--

2049 | Mr. DELLUMS. Yes, without objection.

2050 | [The information follows:]

2051 |

2052 | ***** COMMITTEE INSERT *****

INSERT FOR THE RECORD							
HOUSE		APPROPRIATIONS COMMITTEE	HOUSE		ARMED SERVICES COMMITTEE	HOUSE	OTHER
SENATE			SENATE			SENATE	
HEARING DATE		TRANSCRIPT PAGE NO.	LINE NO.		INSERT NO.		
3/14/89		85	2032				

Answer provided in SECRET addendum to transcript.

2053 Mr. HUNTER. Thank you, Mr. Chairman.

2054 Mr. DELLUMS. The Chair would note that it is a little
2055 after 12:00, but sometimes we have gone to 12:30. The Chair
2056 would like to indicate to the gentleman from Arizona that he
2057 said that, time permitting, he would be happy to yield to
2058 the gentleman for any follow-on questions. If the gentleman
2059 wants to ask questions, the Chair would yield to the
2060 gentleman for that purpose.

2061 Mr. KYL. Thank you, Mr. Chairman.

2062 I would like to note that I, too, had hearings this
2063 morning, but I stuck it out here because you are here,
2064 General Monahan, and I wanted to be here with you this
2065 morning.

2066 Mr. DELLUMS. The gentleman is always there.

2067 Mr. KYL. In view of the time, I would simply like to
2068 quickly go back over one subject and then I am sure we will
2069 have other opportunities to get together, because both you,
2070 Mr. Chairman, and Mrs. Byron, who is no longer here, were
2071 concerned about the nuclear components.

2072 I just want to quickly understand this. It is true,
2073 General Monahan, that the Soviets do use nuclear power in
2074 space now and that we do not; is that correct?

2075 General MONAHAN. That is correct.

2076 Mr. KYL. And it is also true that their ABM system uses a
2077 nuclear--or at least part of their ABM system uses a nuclear

2078 warhead and we don't have any such--

2079 General MONAHAN. I believe, yes, that is true.

2080 Mr. KYL. Thirdly, their long-term research, as ours, does
2081 in part look at some nuclear components primarily for power
2082 purposes, but perhaps even theoretically a laser for weapon
2083 way down the road. Is that correct?

2084 General MONAHAN. They could. It could be.

2085 Mr. KYL. Is it also true that part of the reason we
2086 research these things is so that we can understand what the
2087 Soviets might be doing--

2088 General MONAHAN. Yes.

2089 Mr. KYL. --not necessarily to deploy a system ourselves.

2090 Fourth, that all of our phase 1 defense, you said, is non-
2091 nuclear--

2092 General MONAHAN. That is true.

2093 Mr. KYL. --as it is proposed.

2094 General MONAHAN. That is true.

2095 Mr. KYL. This isn't necessarily your area, but I think
2096 you--and we all know the answer to this question--is it not
2097 also true that all of our strategic offensive deterrent is
2098 nuclear?

2099 General MONAHAN. The word ''all'' gets to be--

2100 Mr. KYL. An awfully large part of our strategic offensive
2101 deterrent is nuclear.

2102 General MONAHAN. You have to be at least 99 percent

2103 correct with that statement.

2104 Mr. KYL. As Perry Mason says, Mr. Chairman, 'I rest my
2105 case.'

2106 Mr. DELLUMS. The gentleman yields back his time.

2107 General, we talked informally in our introductory meeting
2108 about the relationship between SDI and ASAT. I would like
2109 to bring you to that issue on the record.

2110 In your prepared remarks, you spoke of protecting the SDI
2111 components from ASATs and would you please explain how this
2112 will be done. My follow-on question is this: If it can be
2113 done to components--that is, protect--components of SDI, why
2114 couldn't the same measures be taken to protect our
2115 satellites, therefore removing the need to develop ASAT?
2116 However, if SDI components can't be fully protected from
2117 ASAT, wouldn't that mean that a fully deployed ASAT program
2118 would render SDI vulnerable and therefore not survivable?

2119 General MONAHAN. Okay. Let me just do my best that I can
2120 to answer that without trying to get classified.

2121 I think you would have to look at it philosophically that
2122 there is probably no such thing as a perfect ASAT; there is
2123 no such thing as an absolutely perfect satellite system that
2124 is immune from an ASAT either.

2125 Mr. DELLUMS. Let's contemplate a laser ASAT program.

2126 General MONAHAN. Okay, but even with a laser ASAT, I
2127 believe that you would have ways to counter lasers, so--just

2128 because a laser ASAT may be one way of doing a job, there
2129 are ways--like I say, I want to keep from getting classified
2130 here, but there are ways to develop countermeasures against
2131 lasers also. So that part of it is not hopeless.

2132 I don't think you can talk very definitively one way or
2133 the other on the subject, and I think there would be a give
2134 and a take. We have electronic warfare equipment that we
2135 ^{has} ~~have been~~ constantly ~~has been~~ updated over the last 30, 40
2136 years that--it operates--you know, certain of the radio
2137 frequency equipment radars, et cetera, can operate very well
2138 on certain jamming environments. Other jamming
2139 environments, they can't work quite as well. It is a system
2140 of measures, countermeasures and counter-countermeasures. I
2141 think you are looking at the same thing here when you look
2142 at ASATs and also look at satellites.

2143 But when you have one side, the reason for the high
2144 priority on ASATs, of course, is that the Soviets have that
2145 capability today, and they can take down a lot of our
2146 satellites we have up there today, but theirs go scott free
2147 as of present time. We don't have a way to fight back. So
2148 that is what is behind the ASAT priority.

2149 Mr. DELLUMS. Does the gentleman from Pennsylvania have
2150 any additional questions?

2151 Mr. WELDON. No.

2152 Mr. DELLUMS. If not, General, we would like to thank you

2153 for your presentation this morning.

2154 The Chair, without objection, would submit a number of
2155 written questions and ask you to respond for the record.

2156 [The information follows:]

2157

2158 ***** COMMITTEE INSERT *****

2159 Mr. DELLUMS. Again, we appreciate your presentation this
2160 morning. The Chair would like to indicate to my colleagues
2161 that we will meet tomorrow morning at 10:00 a.m., in 2118,
2162 where the subject matter will be the ASAT program.

2163 The subcommittee stands in adjournment until 10:00 a.m.,
2164 tomorrow morning, room 2118.

2165 [Whereupon, at 12:15 p.m., the subcommittee was adjourned,
2166 to reconvene at 10:00 a.m., Wednesday, March 15, 1989.]

* * * SPEAKER LISTING * * *

RPTSTETER	1,	27,	51,	79
DCMNTETER	1,	27,	51,	79
DELLUMS	2,	7,	31,	33,
34,	35,	36,	38,	39,
48,	52,	53,	60,	64,
81,	83,	84,	85,	86,
91				88,
				89,
DICKINSON	4,	20,	24,	54,
55,	56,	57,	58,	59
MONAHAN	8,	20,	24,	32,
34,	35,	37,	38,	41,
47,	49,	50,	52,	54,
57,	58,	61,	62,	63,
66,	67,	68,	69,	71,
74,	75,	76,	77,	78,
81,	85,	86,	87,	88
ASH	41			
KYL	42,	43,	44,	45,
46,	47,	48,	49,	52,
73,	86,	87,	88	53,
				72,
SCHNELZER	43,	44,	45	
MCCURDY	49,	52,	64,	65,
66,	67,	68,	69,	70,
73,	74,	75,	76,	77,
				78
GRIFFIN	58,	59		
FOGLIETTA	60,	62,	63,	64
BYRON	78,	79,	81	
WELDON	81,	84,	89	
HUNTER	84,	85,	86	

* C O N T E N T S *

STATEMENTS OF:

STATEMENT OF LIEUTENANT GENERAL GEORGE L. MONAHAN, DIRECTOR,
STRATEGIC DEFENSE INITIATIVE ORGANIZATION

PAGE... 8

* INDEX OF INSERTS *

INSERT NUMBER:

***** INSERT 2-1 *****

PAGE... 30

***** COMMITTEE INSERT *****

PAGE... 66

***** COMMITTEE INSERT *****

PAGE... 70

***** COMMITTEE INSERT *****

PAGE... 85

***** COMMITTEE INSERT *****

PAGE... 90

HASC TESTIMONY



14 MAR 89

Lt Gen George L. Monahan, Jr.
Director
Strategic Defense Initiative Organization



SDIO OBJECTIVES

As Set Forth In DoD Directive 5141.5 "Strategic Defense Initiative Organization", Original Dated 21 Feb 86

- **Conduct Vigorous Research Program To Develop Key Technologies For Defense Against Ballistic Missiles**
- **Consider Options To Increase The Contribution Of Defenses To US And Allied Security**
- **Protect Options For Near-Term Deployment Of Limited Ballistic Missile Defense**
- **Carry Out Program In Full Consultation And, Where Appropriate, With Participation Of Our Allies**

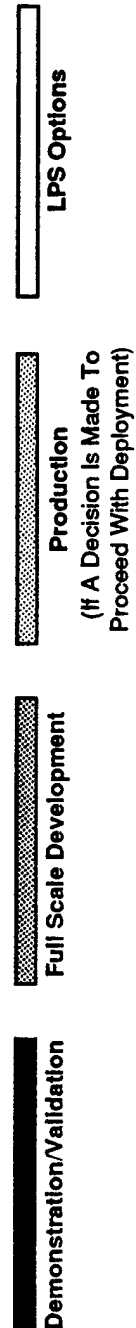
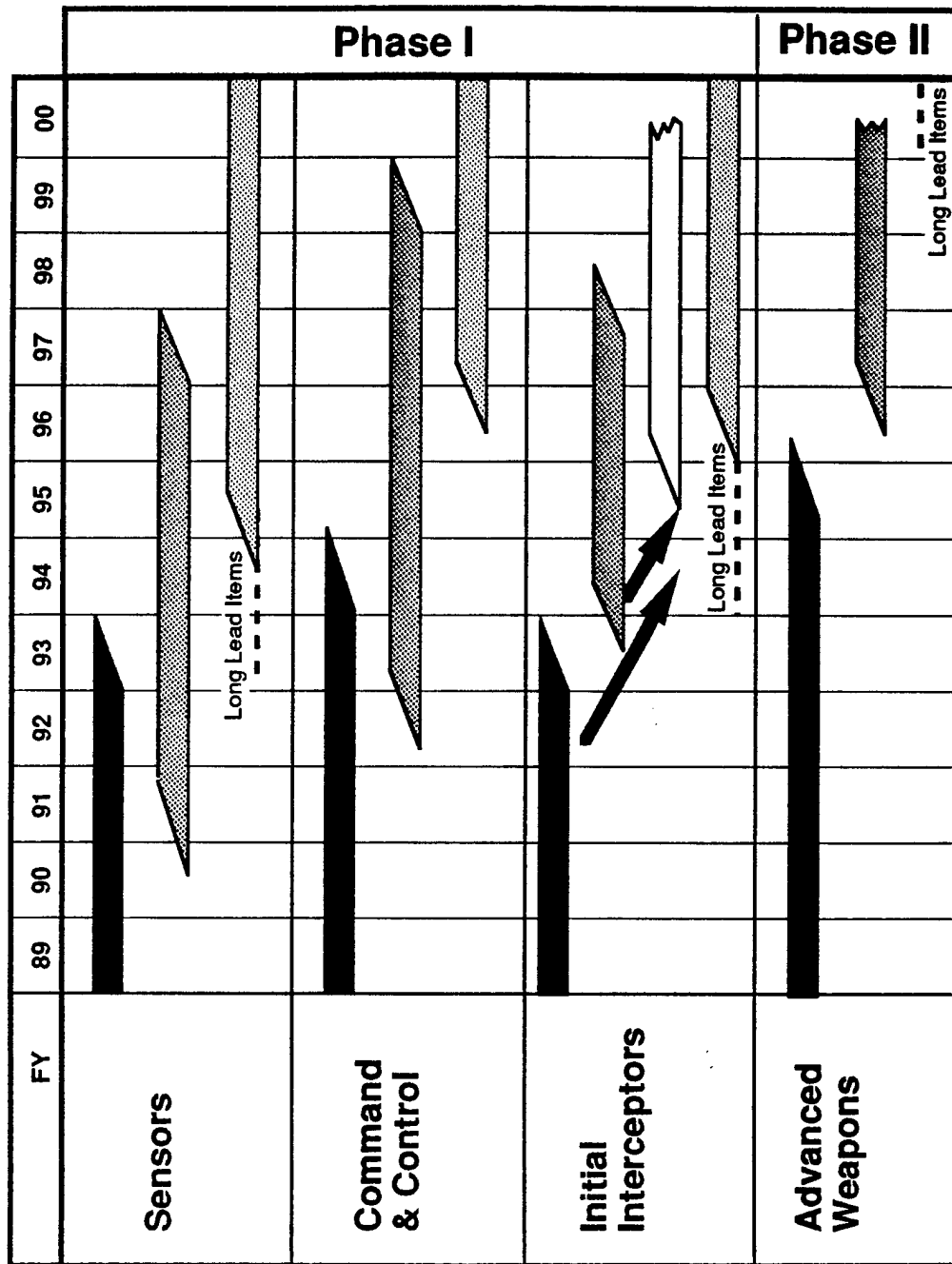


CURRENT PROGRAM STRUCTURE

- Based On SDI Charter And JCS Requirement
- Defense Acquisition Board (DAB), October 1988
 - Multi-Phased Program
 - Phase I To Proceed Into Demonstration / Validation Phase
 - Subsequent Phases To Be Addressed At Later DABs

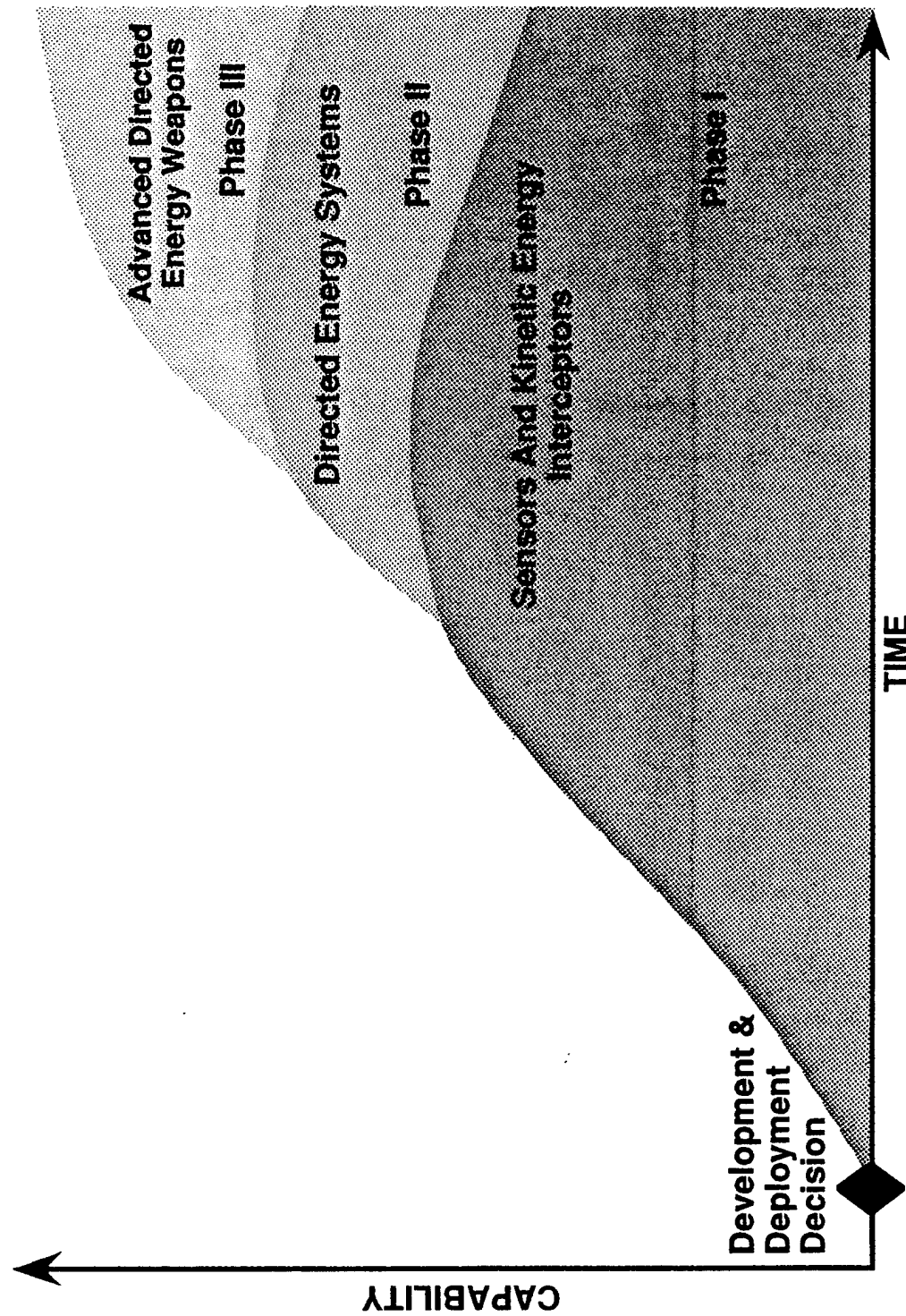


SDS PROGRAM SCHEDULE (Oct 88 DAB)



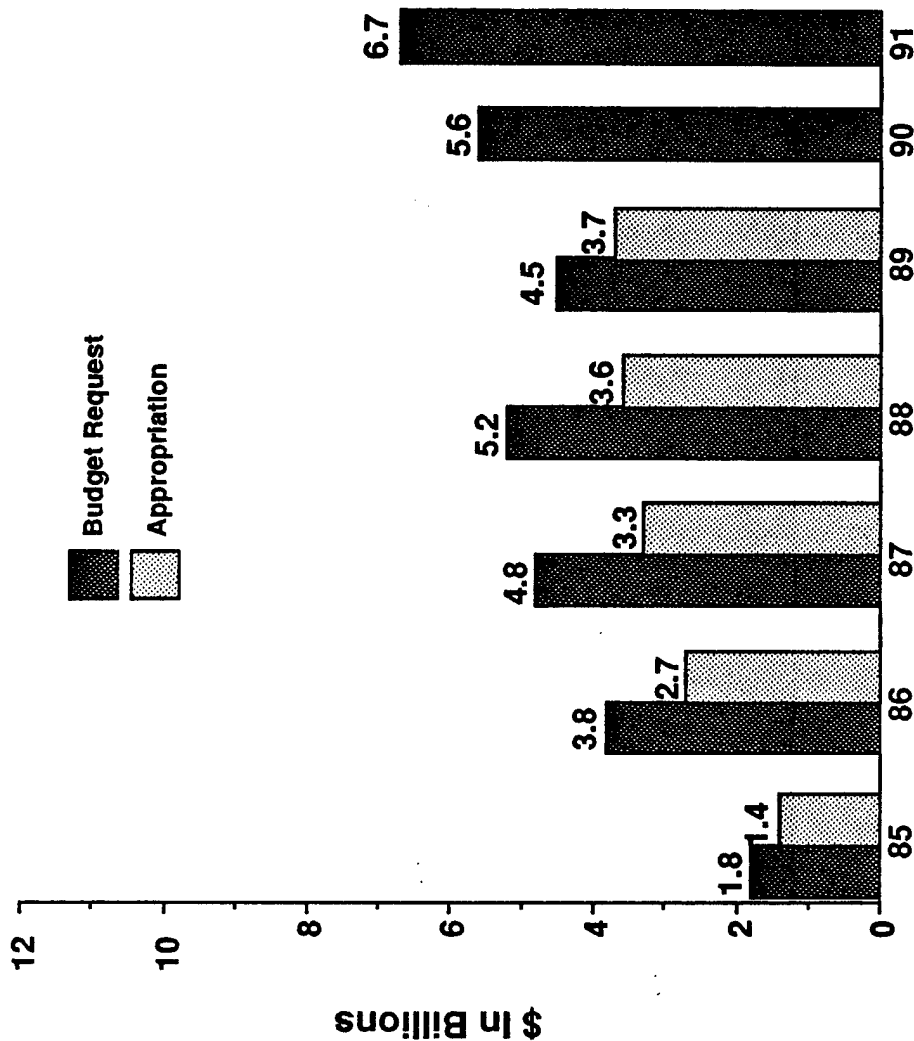


THE PATH TO "THOROUGHLY RELIABLE" DEFENSES





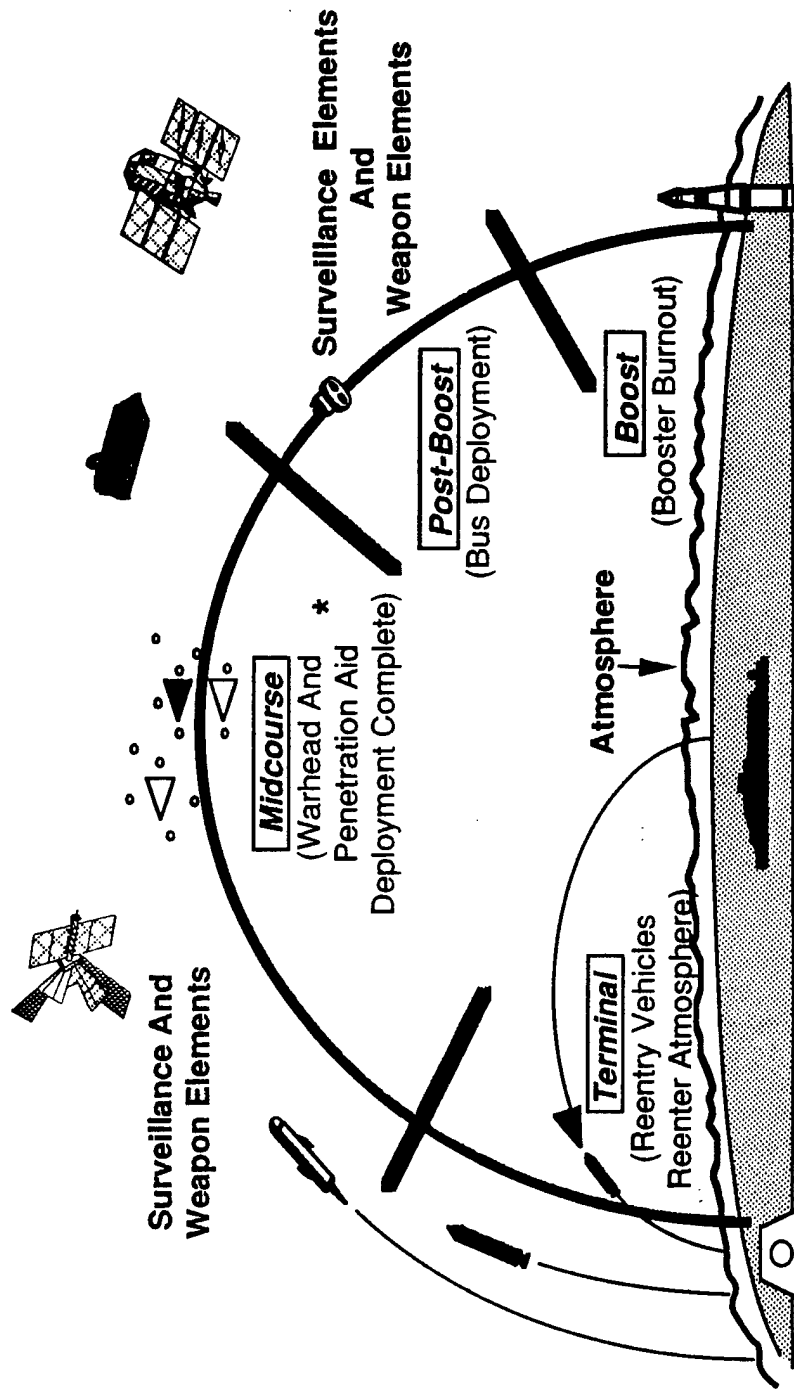
SDIO BUDGET



\$20.1B Requested / \$14.7B Appropriated



SDS PHASE ONE ARCHITECTURE



We Are Building A System



SDS PHASE ONE PROGRAM

Major Elements

- BSTS - Boost Surveillance And Tracking System**
- SSTS - Space Surveillance And Tracking System**
- GSTS - Ground-Based Surveillance And Tracking System**
- GBR - Ground Based Radar (Pending)**
- CC - Command Center**
- GBI - Ground-Based Interceptor**
- SBI - Space-Based Interceptor**



BOOST SURVEILLANCE & TRACKING SYSTEM

Functions

- **Surveillance - Continuous Global Observation Of The Earth's Surface**
- **Detection - ICBMs, IRBMs, SLBMs**
- **Acquisition - Initiate Tracking Of Missiles**
- **Tracking - Compute State Vectors And Predict Future Positions**
- **Typing - Determine The Missile Type**
- **Kill Assessment - Provide Data To Assist In Determination Of A Hit Or Kill**
- **Communications - Transmit Required Data To All Users**
- **Battle Management - As Determined By The SDS Architecture**

Characteristics

Size:	Approx. 36 x 16 Ft.
Bands:	Multispectral
Sensor:	Scanning Or Staring
Power:	6 - 10 Kw
Total Spacecraft Weight:	5000 - 7000 Kg (11,000 - 15,400 Lbs)

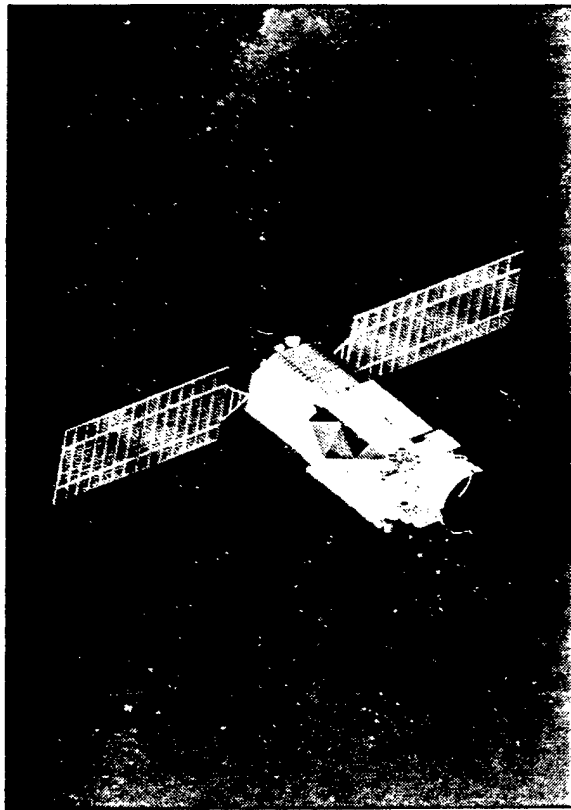
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CURRENT SPACECRAFT CONCEPTS



GRUMMAN



LOCKHEED



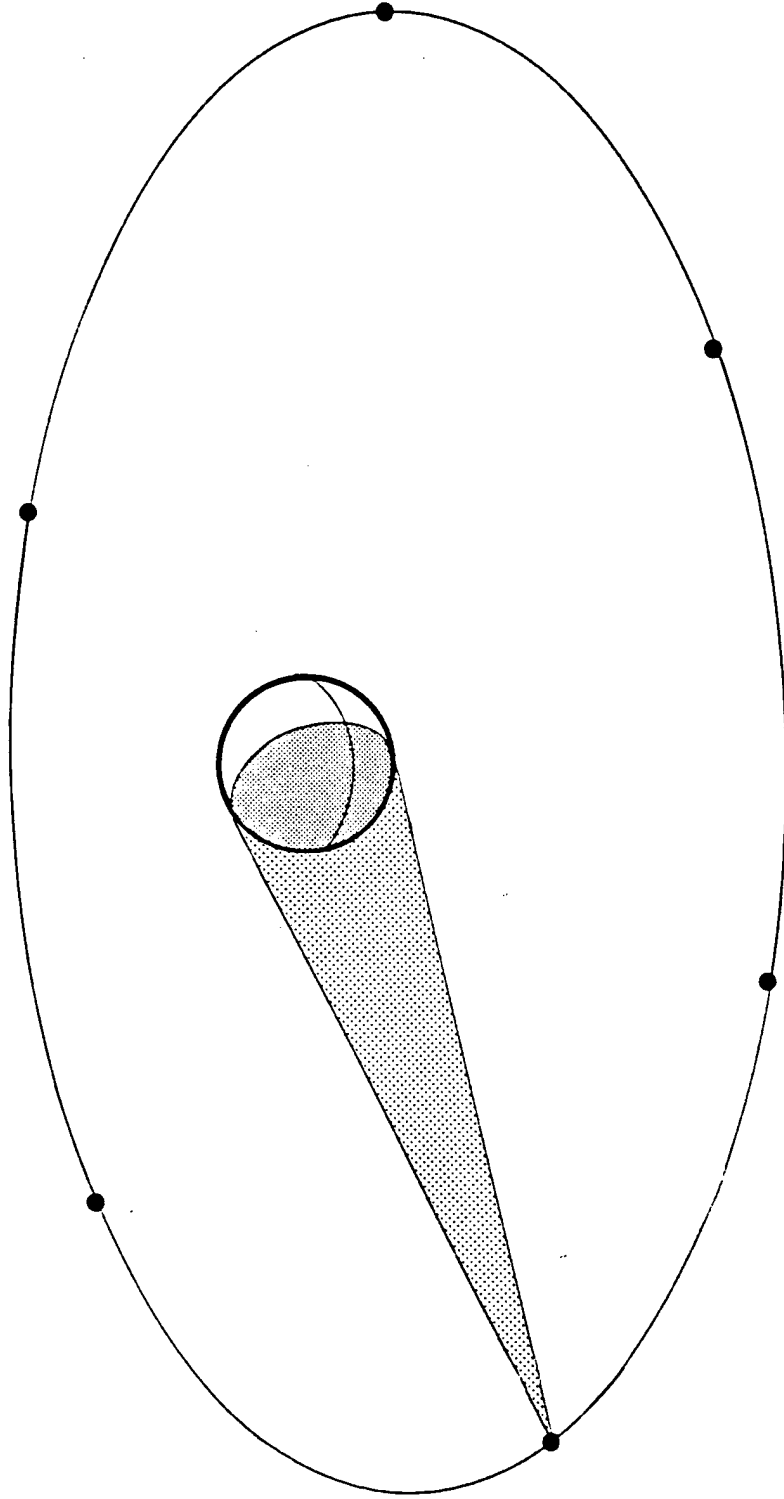
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10 Feb 89



UNCLASSIFIED

NOTIONAL BSTS COVERAGE



UNCLASSIFIED



SPACE SURVEILLANCE & TRACKING SYSTEM

Functions

- Acquire And Track ASATs, PBVs, And RVs
- Fire Control For SBI
- Handover Unresolved Clusters To GSTS And GBR
- Space Surveillance Worldwide
- Foreign Target Data Collection

Characteristics

Aperture:	< 1.0 Meter
Sensor:	Scanning
Revisit Time:	< 10 Sec
No. Of Detectors:	< 10 ⁵
Bands:	Multispectral

UNCLASSIFIED



SPACE SURVEILLANCE AND TRACKING SYSTEM (SSTS)



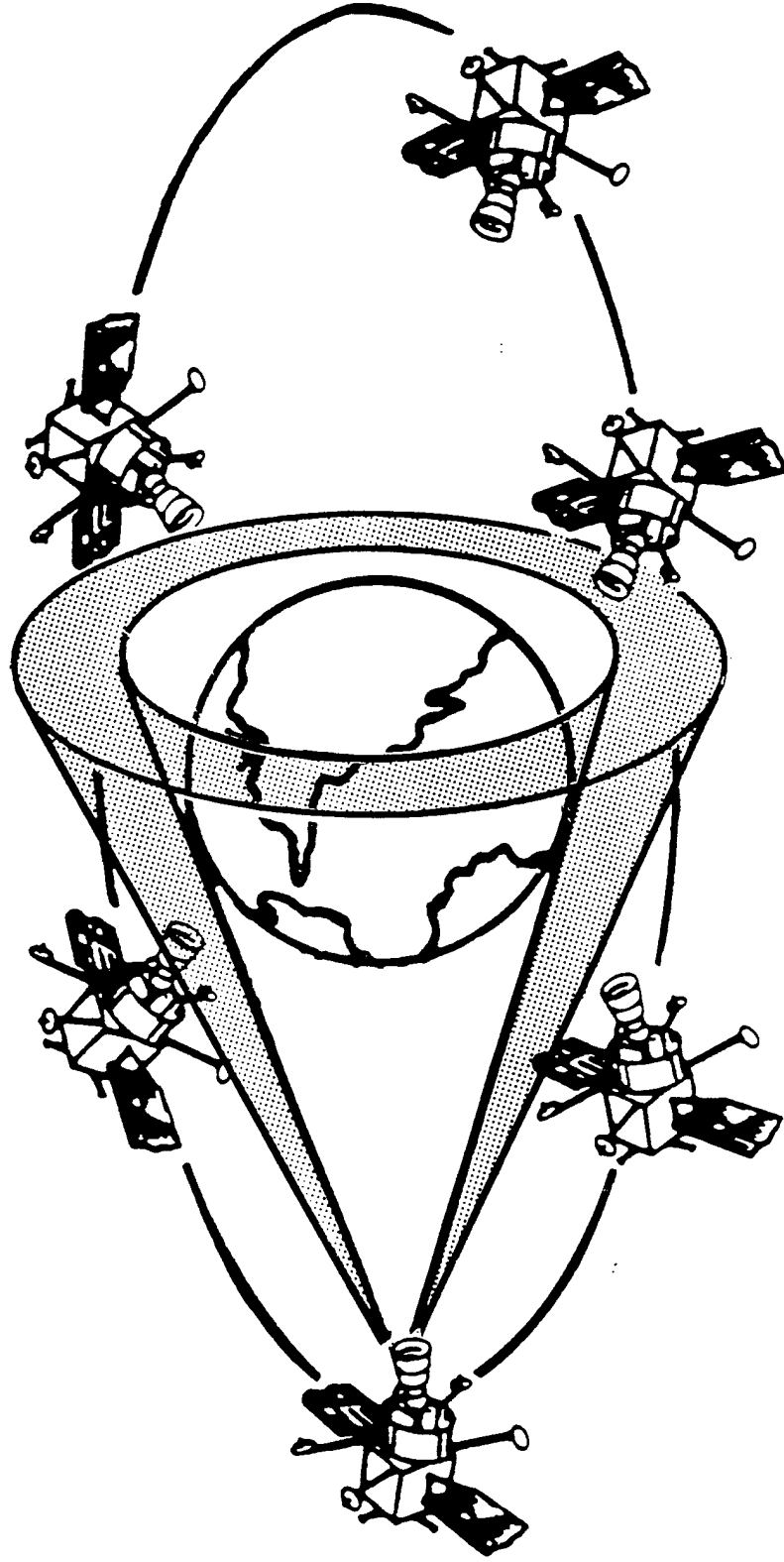
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UNCLASSIFIED

SPACE SURVEILLANCE AND TRACKING SYSTEM (SSTS)



87U-1042/1
9 Feb 89

UNCLASSIFIED



GROUND-BASED SURVEILLANCE & TRACKING SYSTEM

Functions

- Track And Discriminate RVs From Penajids
- Reconstitution Of Space Surveillance Capability Due To Attrition
- Acquire & Track Low Altitude SLBMs

Characteristics

Aperture:	< 1.0 Meter
Sensor:	Scanning
Revisit Time:	< 10 Sec
No. Of Detectors:	< 10 ⁵
Bands:	Multispectral

UNCLASSIFIED



GROUND-BASED SURVEILLANCE AND TRACKING SYSTEM (GSTS)

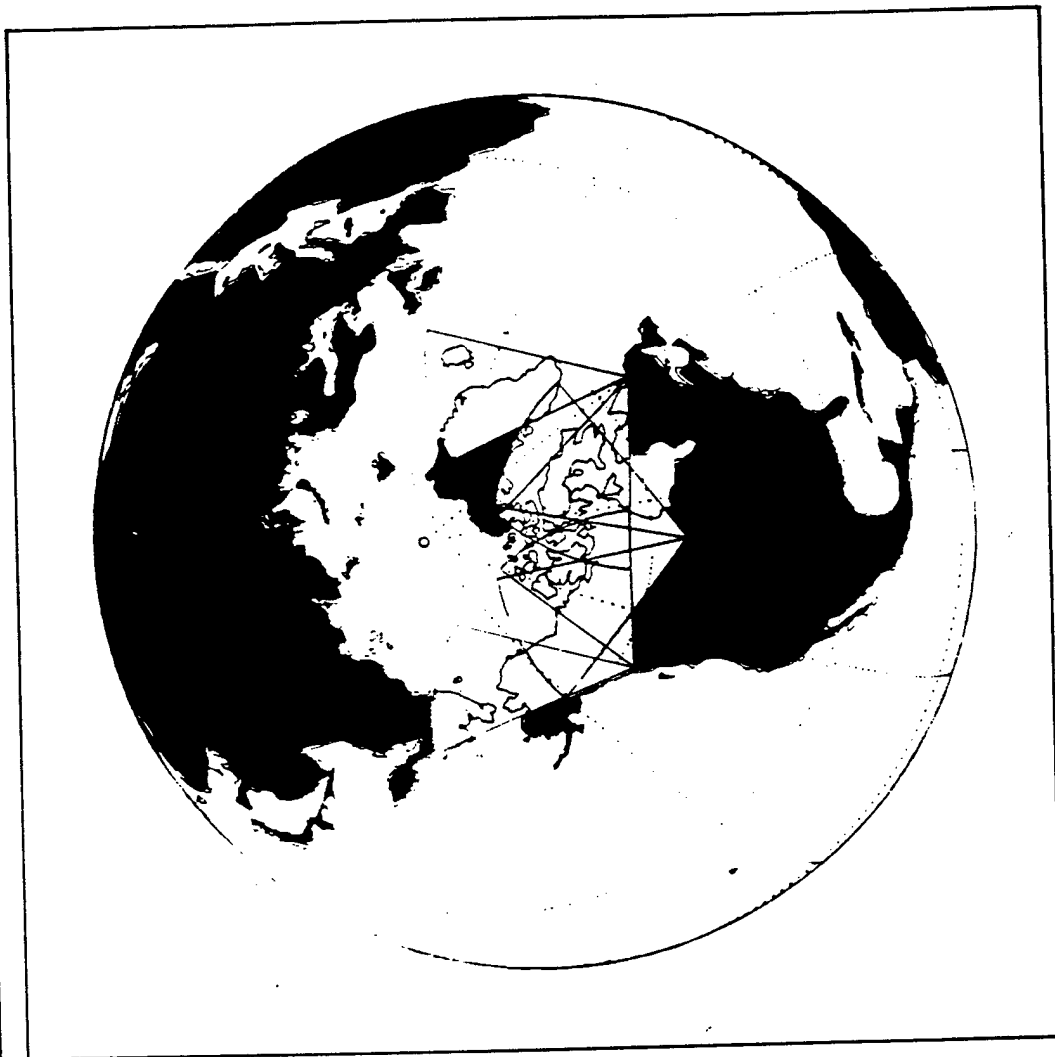


VG 88 U 1019 1
10 Mar 89

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GSTS COVERAGE



89U 0191
8 Feb 89

UNCLASSIFIED



GROUND-BASED RADAR

Functions

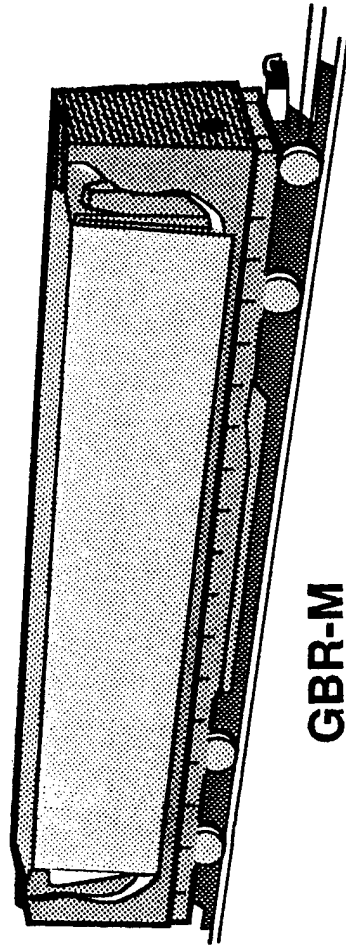
- **Acquire, Track & Discriminate RVs In The Presence Of Decoys**
- **In-Flight Guidance To Space And Ground-Based Interceptors**
- **Kill And Damage Assessment**

Characteristics

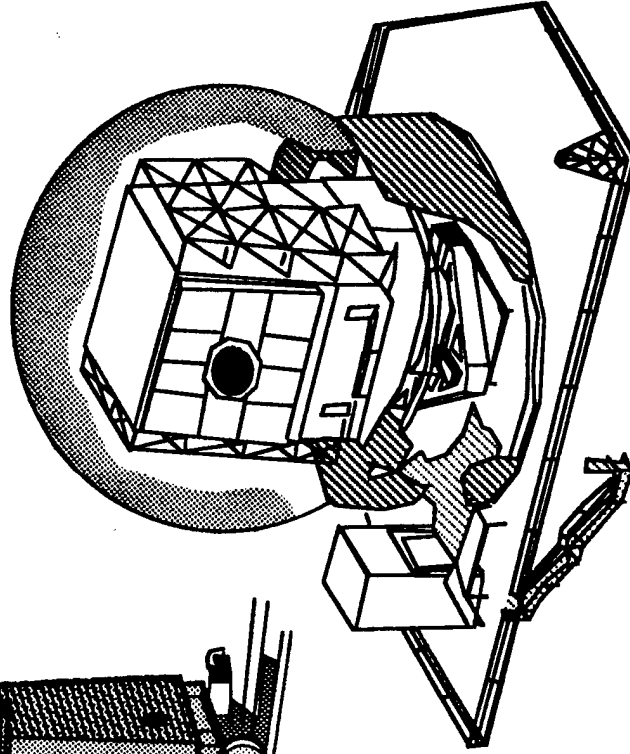
- **X-Band Phase Array Radar**
- **290,000 Phase Shifters**
- **High Precision Range Resolution**
- **Rail Mobile Or Fixed Based**



GROUND BASED RADAR



GBR-M



GBR-X



COMMAND CENTER

Functions

- "Man-In-Control"
- Global Attack Assessment
- Battle Plan Execution
- Real-Time Support To Other Warfighting CINC's
- Strategic Defense Reconstitution

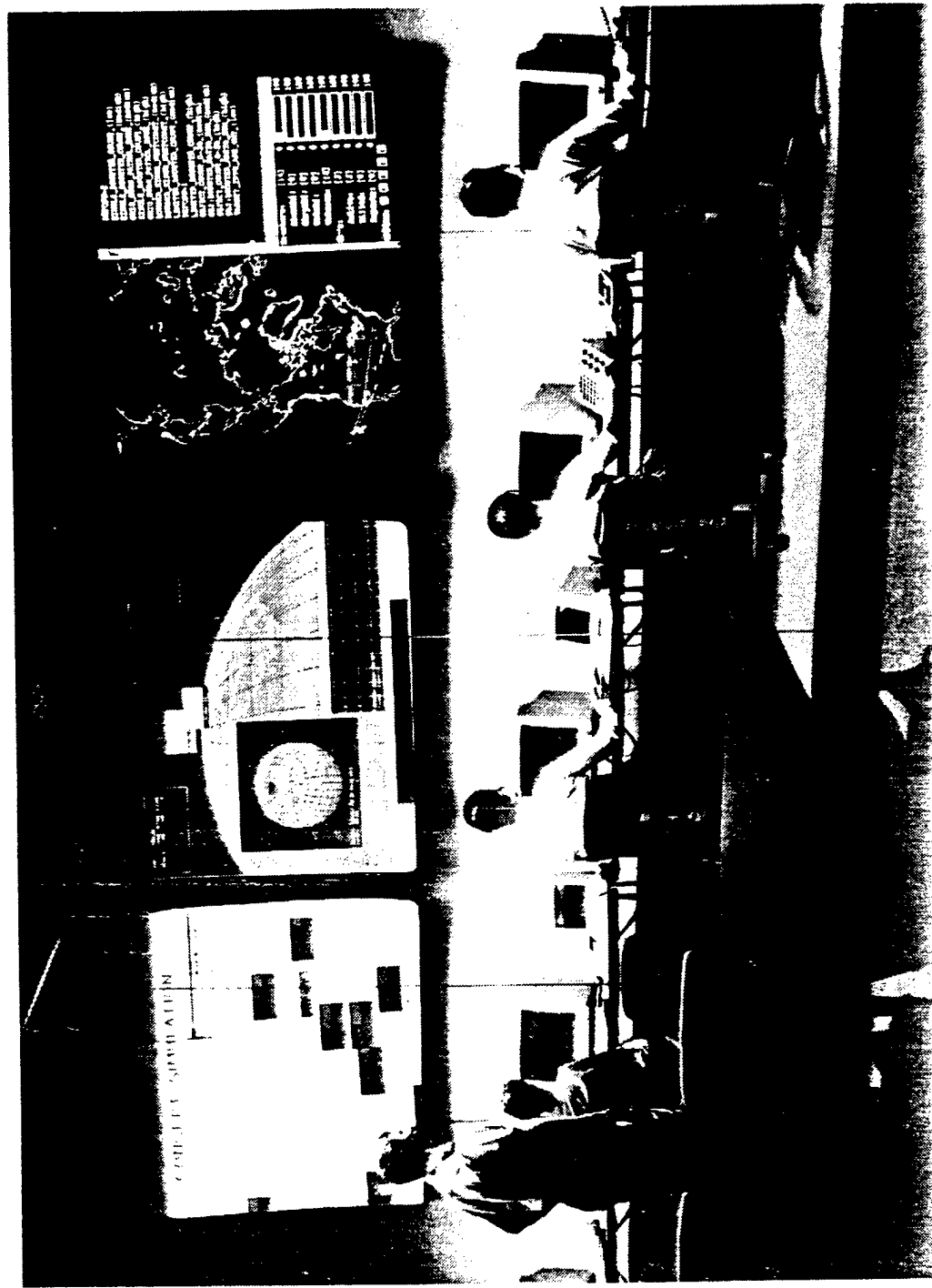
Characteristics

- Fixed And Mobile Command Centers
- Robust Space And Ground Communication & Data Networks
- Multiple Interfaces With Unified & Specified CINC's



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EV-88 SIMULATION



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890 0124
010689



GROUND-BASED INTERCEPTOR

Functions

- Intercept RVs In Midcourse
- Provide Terminal Target Lock-On In Countermeasure Environment
- Provide For Adaptive & Preferential Defense Of Blue Forces And Targets

Characteristics

- Low Cost
- Lightweight: ~700 Kg (1540 Lbs)
- Hit-To-Kill
- "Dormant" Missile Concept



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GROUND-BASED EXPERIMENTAL INTERCEPTOR



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SPACE-BASED INTERCEPTOR

Functions

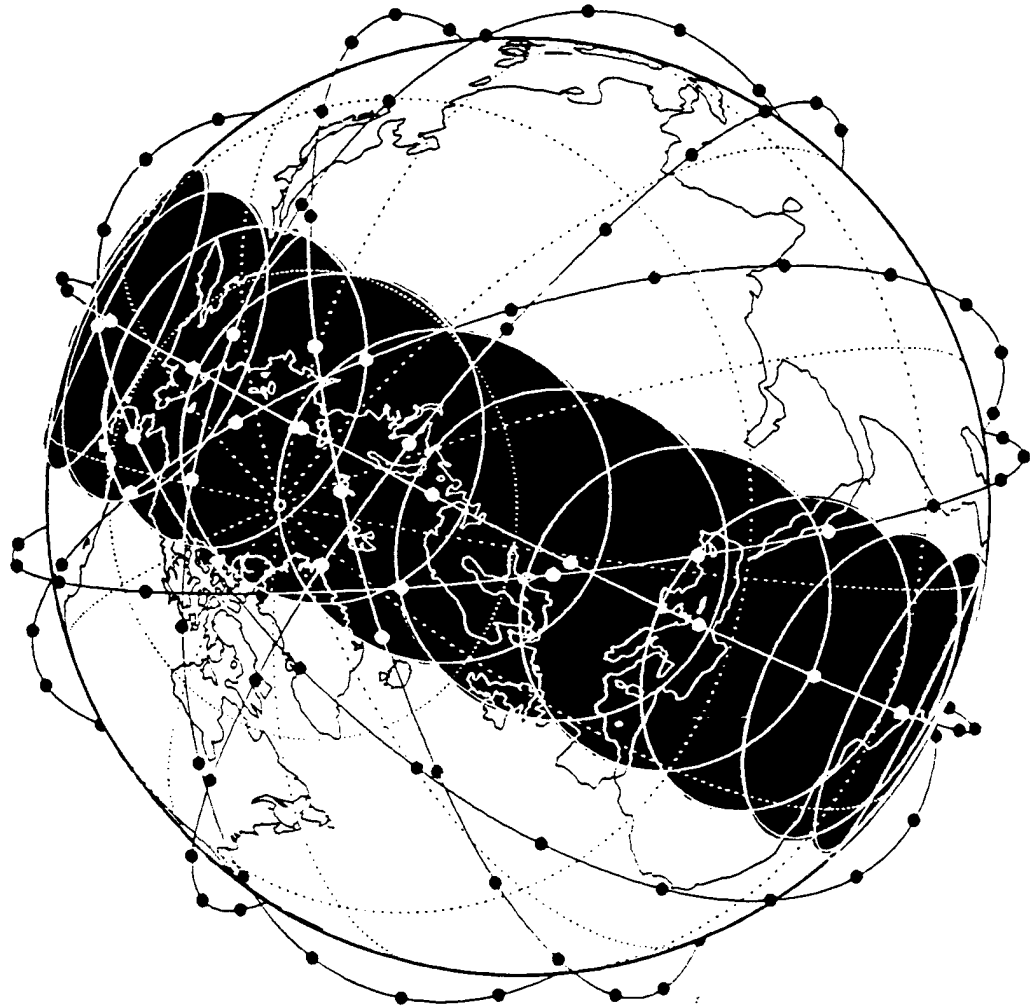
- Destruction Of Boosters, PBVs, RVs And ASATs In The Boost, Post-Boost And Midcourse Phases
- Target Lock-On And Steering During Terminal Phase Of Intercept

Characteristics

- Carrier Vehicle — 3000 Kg (6600 Lbs)
- Interceptor — Low Cost / Long Life
- Hit-To-Kill

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SBI COVERAGE

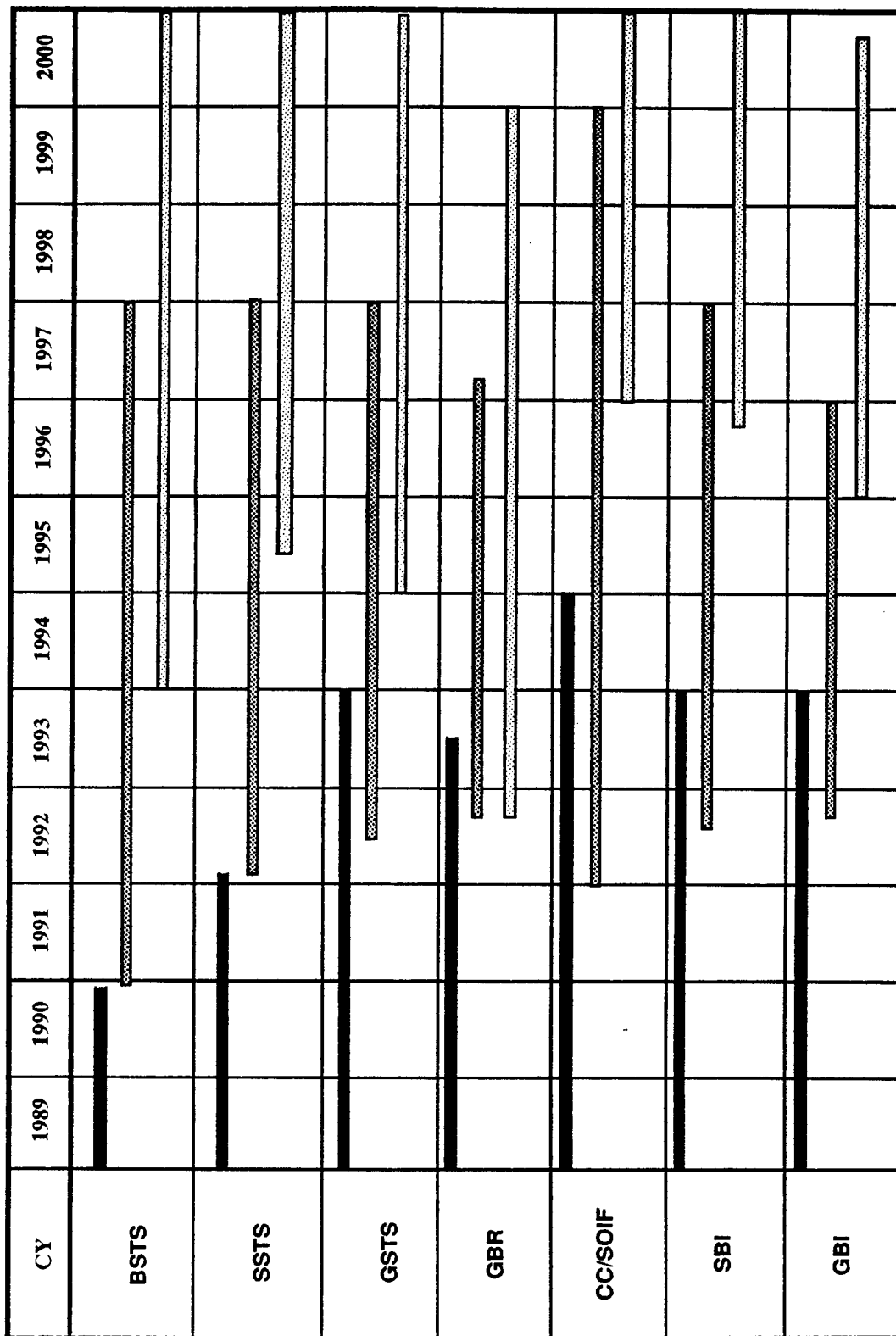


RSU 0170
2 Feb 89
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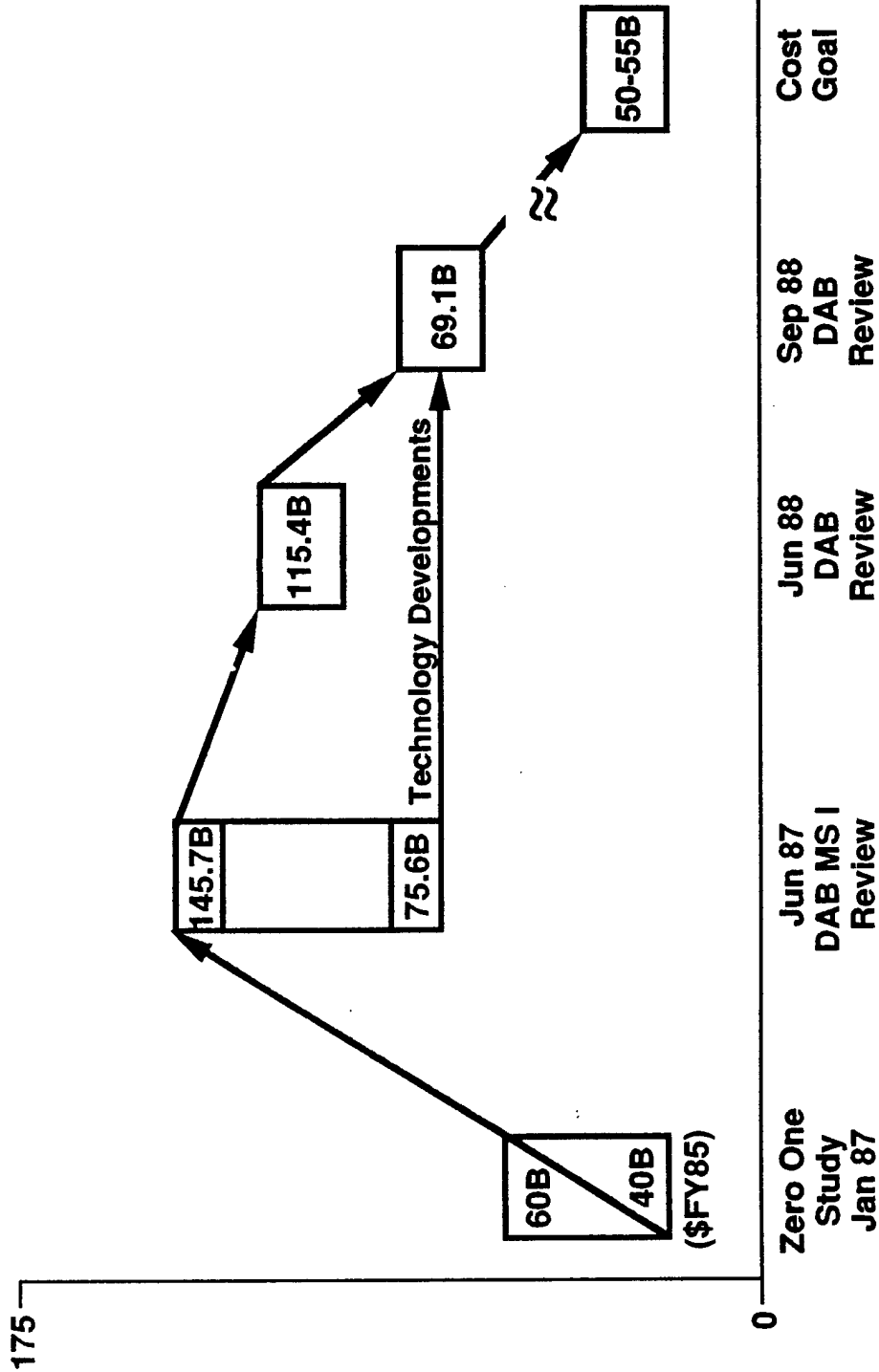
SDS DAB PROGRAM





SDS ACQUISITION COST EVOLUTION

\$B - FY88





BRILLIANT PEBBLE CONCEPT - SBI

Functions

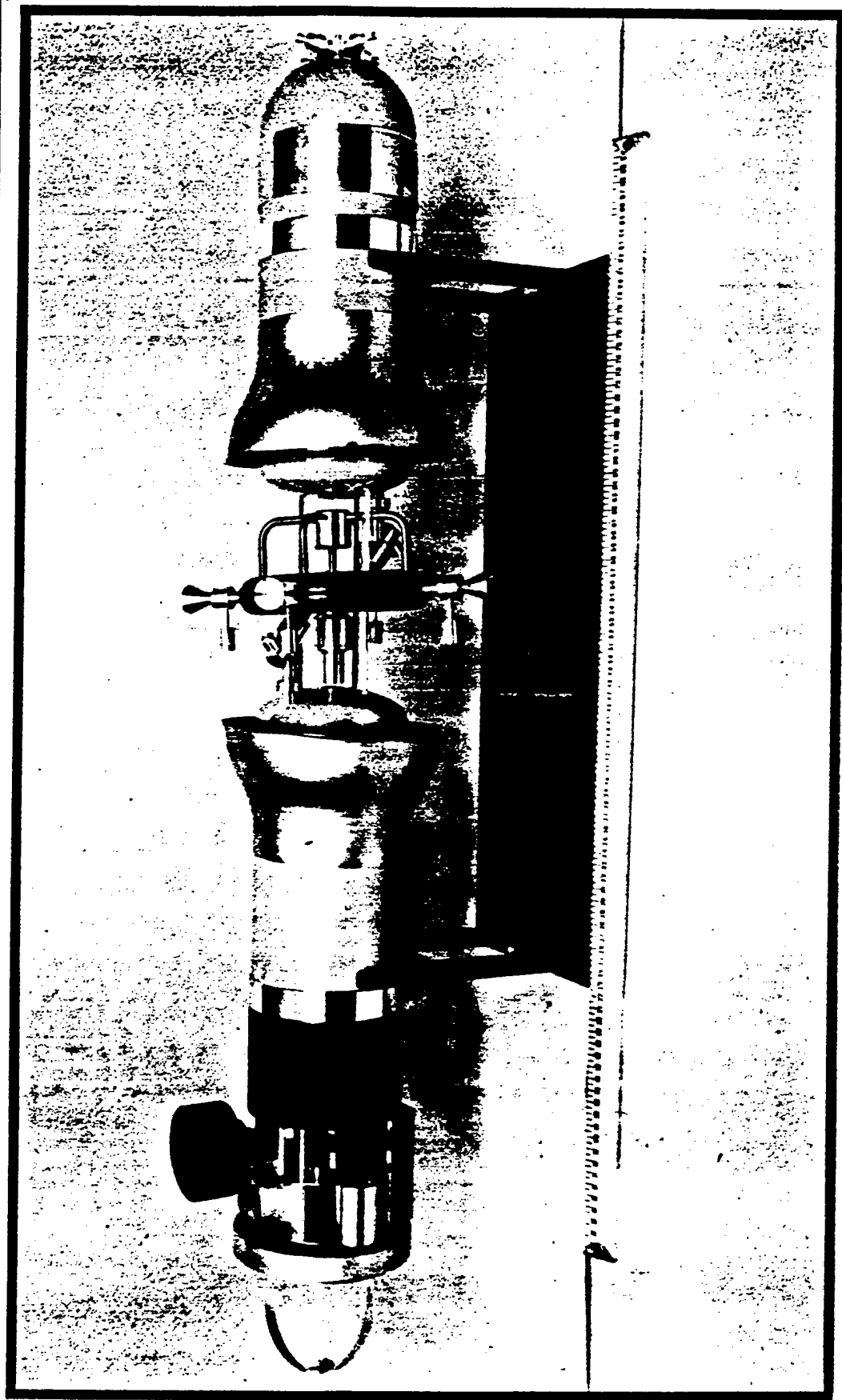
- **Destruction Of Boosters And PBVs**
- **Surveillance And Target Acquisition**
- **Laser 2-Way Communications**

Characteristics

- **Interceptor Orbits In Protective Shell / Life Jacket**
- **Low Cost / Light Weight (88 Lbs)**
- **Highly Survivable Singlets**
- **Hit-To-Kill**



BRILLIANT PEBBLES (U)





FOLLOW-ON SYSTEMS

- HEDI - High Endoatmospheric Defense Interceptor**
- SBL - Space Based Laser**
- NPB - Neutral Particle Beam**
- GBL - Ground Based Laser**



HIGH ENDOATMOSPHERIC DEFENSE INTERCEPTOR

Functions

- Performs High Endoatmospheric Intercept (Terminal Defense Layer)
- Accepts Both Gound-Based And Midcourse Sensor Commit
- Acquires, Homes On, And Destroys An RV With A Non-Nuclear Kill Warhead
- Provides Defense Against Short Flight Time / Depressed Trajectories

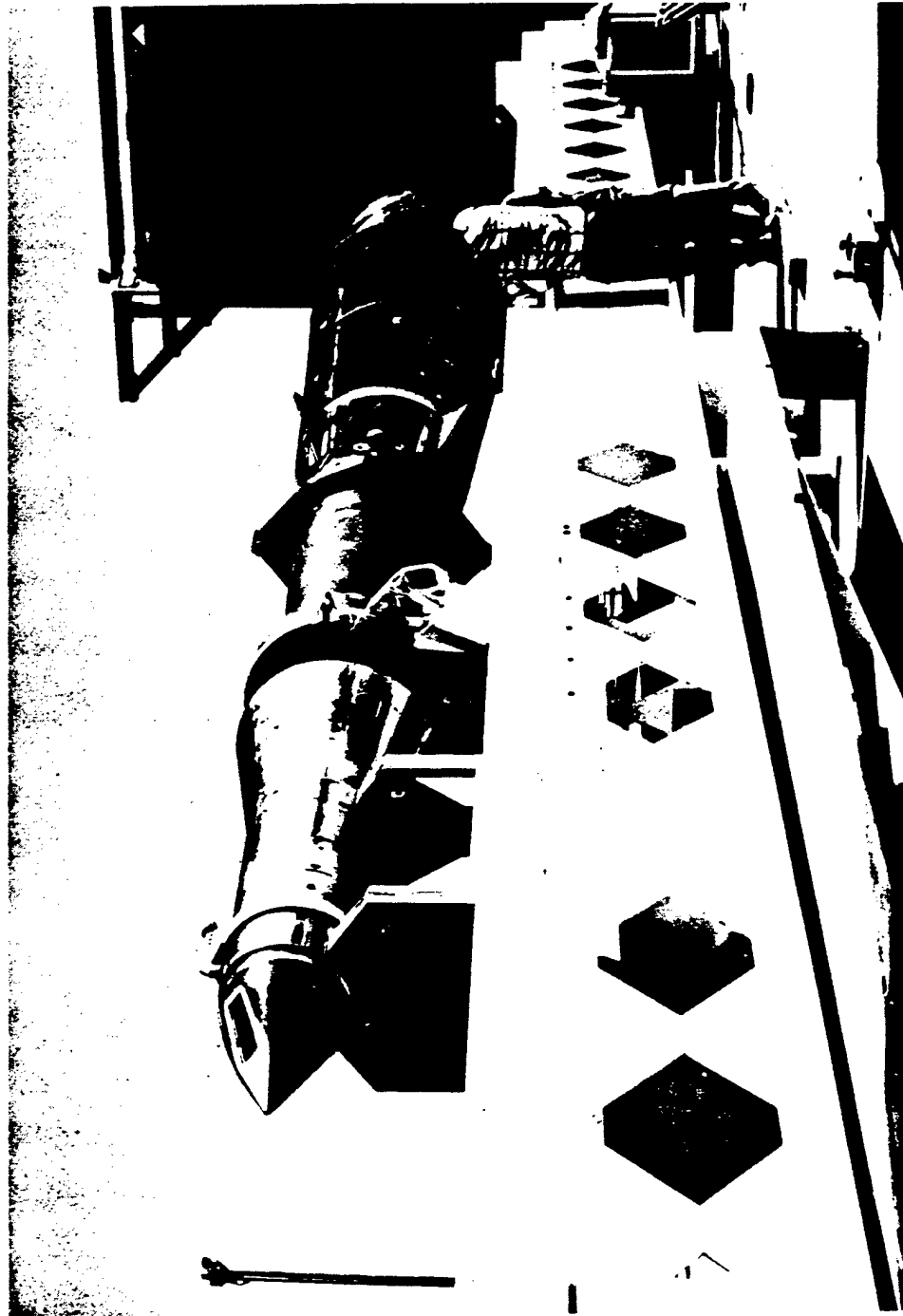
Characteristics

- Kill Vehicle Weight <170 Kg (90 Lbs)
- Battlespace Altitude >70 Km (38 nm)
- IR Passive Seeker



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HEDI AT WHITE SANDS



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89U-0376
8 Mar 89



SPACE-BASED LASER

Functions

- Intercept Boosters And PBVs
- Capability For Surveillance, Detection And Track Of Boosters, PBVs And RVs

Characteristics

- Speed-of-light Delivery
- Rapid Retargeting
- Multispectral Sensors With Very Large Aperture Collectors
- Weight: 220,000 Lbs



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ZENITH STAR



VG 88 U 0689
14 Mar 88

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NEUTRAL PARTICLE BEAM

Functions

- Destroy Boost And Post Boost Vehicles
- Discriminate RV's From Decoys

Characteristics

- Rapid Retargeting / Multiple Shot Capability (17 / Sec)
- Operates In Hostile Nuclear Environment
- Kills Target By Indepth Penetration
- 116,000 Lbs Weight 120 Ft Length



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NEUTRAL PARTICLE BEAM SPACE EXPERIMENT



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89U-0365
6 Mar 89



GROUND-BASED LASER

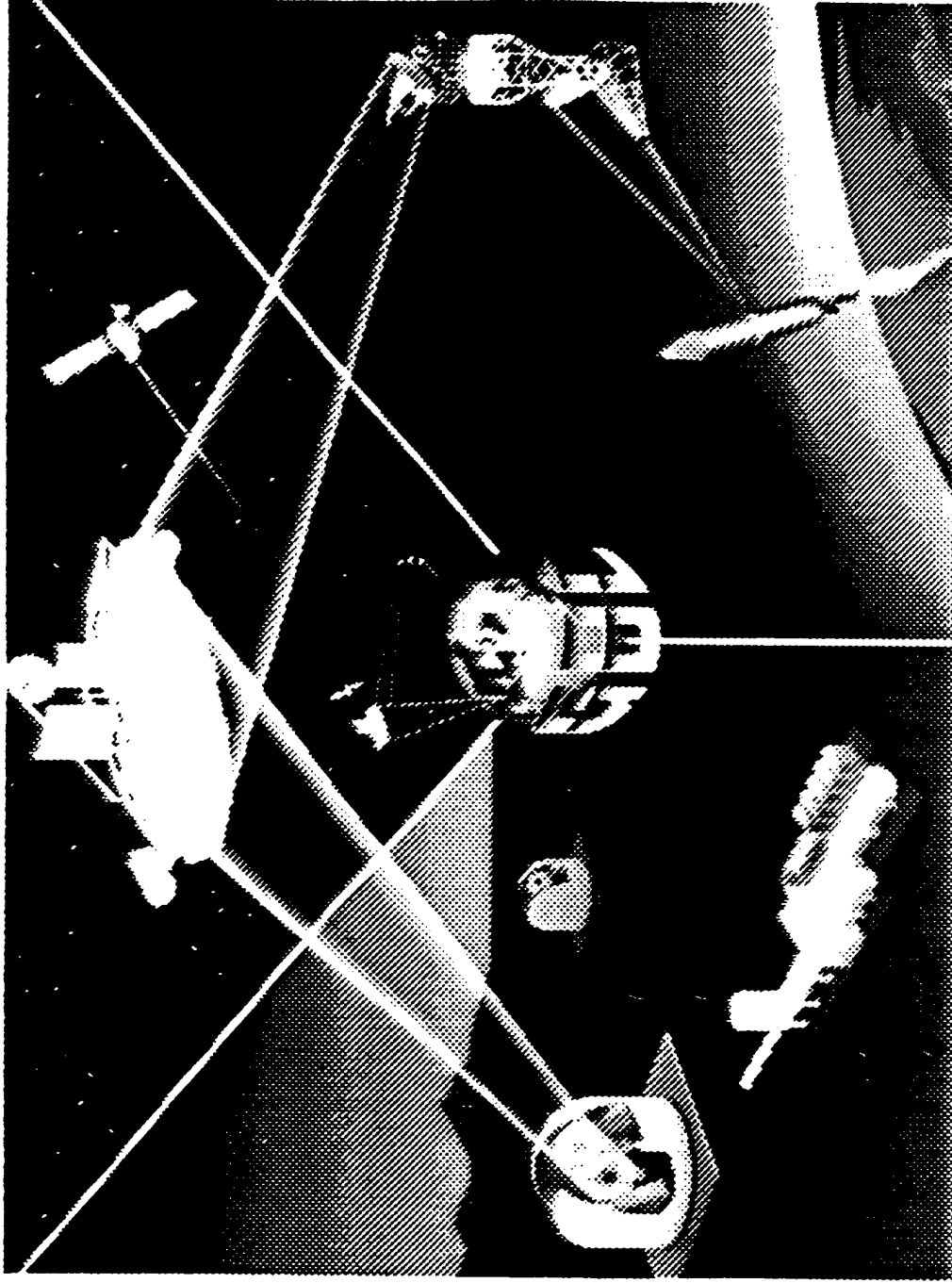
Functions

- Destroy Boosters And Post Boost Vehicles
- Discriminate Light Decoys From RV's
- Capability For Surveillance And Track

Characteristics

- Speed-of-light Delivery Into Atmosphere
- Rapid Retargeting
- Infinite Magazine
- Multispectral Sensors With Large Apertures
- Multiple Ground Sites To Avoid Clouds

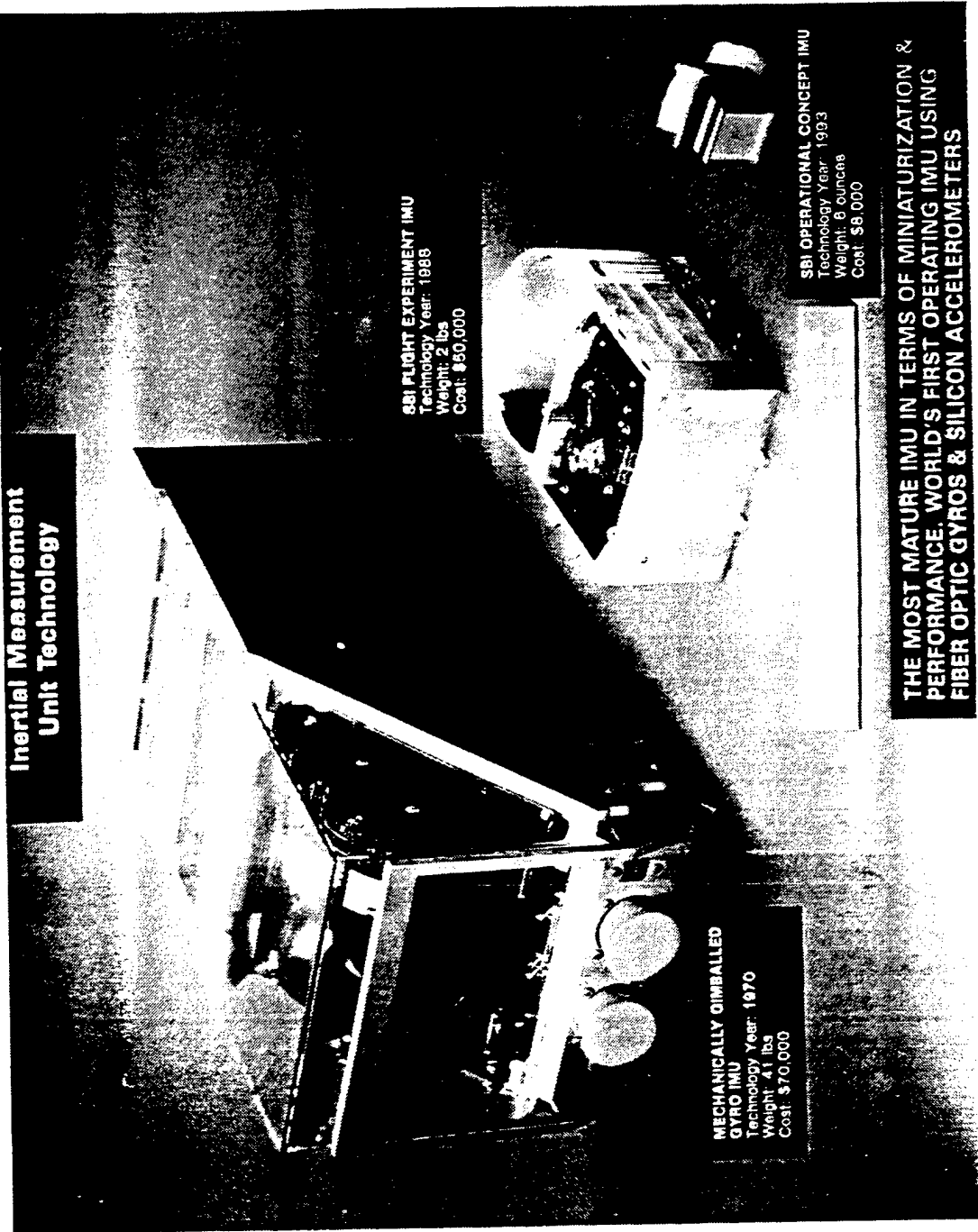
GROUND-BASED LASER





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INERTIAL MEASUREMENT UNIT TECHNOLOGY



Inertial Measurement
Unit Technology

SBI FLIGHT EXPERIMENT IMU
Technology Year: 1988
Weight: 2 lbs
Cost: \$50,000

MECHANICALLY GIMBALLED
GYRO IMU
Technology Year: 1970
Weight: 41 lbs
Cost: \$70,000

SBI OPERATIONAL CONCEPT IMU
Technology Year: 1993
Weight: 6 ounces
Cost: \$8,000

THE MOST MATURE IMU IN TERMS OF MINIATURIZATION &
PERFORMANCE. WORLD'S FIRST OPERATING IMU USING
FIBER OPTIC GYROS & SILICON ACCELEROMETERS

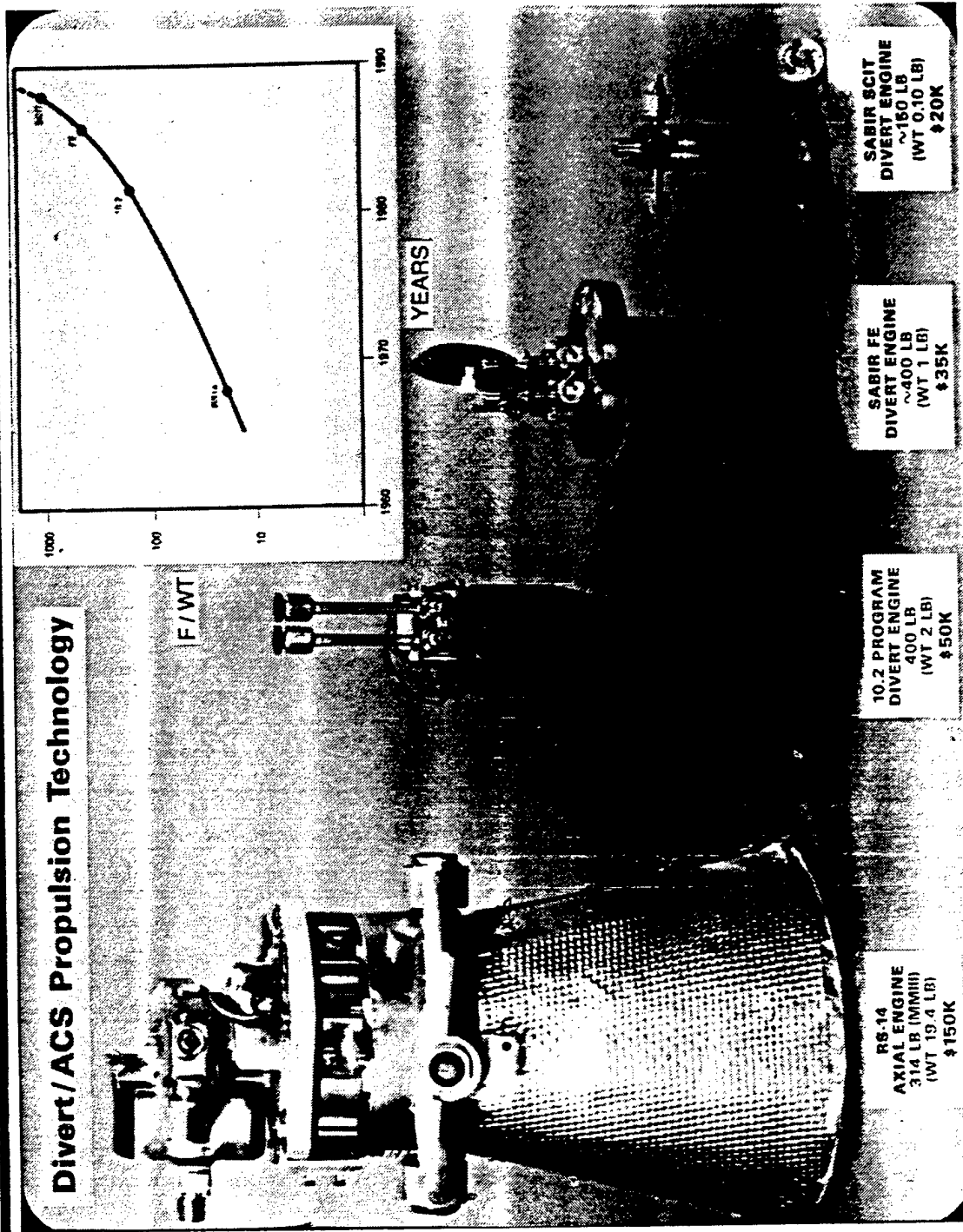
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5010-108-01
12/19/88



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DIVERT/ACS PROPULSION TECHNOLOGY



RRJ JRPB
23 Dec 88

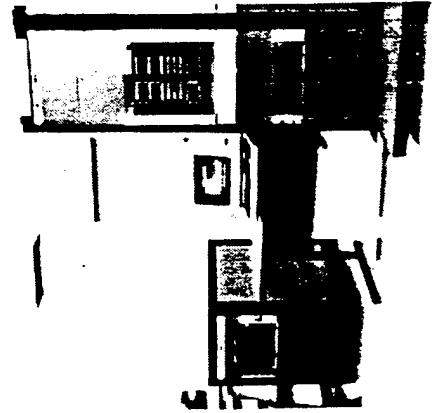
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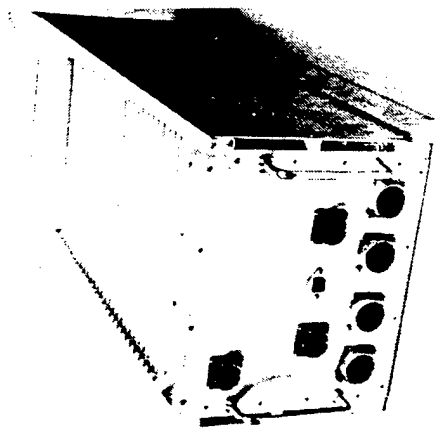
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SPACE PROCESSOR EVOLUTION

ADVANCED DISTRIBUTED
ONBOARD PROCESSOR



AIRBORNE
SURVEILLANCE
TEST BED



GENERIC VHSIC
SPACEBORNE COMPUTER



SIZE
WEIGHT
POWER
ENVIRONMENT
THROUGHPUT
RADIATION
HARDNESS

4.5 FT³
130 LB
1 kW
LAB
3 MIPS
NON
RAD-HARD

2.0 FT³
130 LB
1 kW
FLIGHT
3 MIPS
NON
RAD-HARD

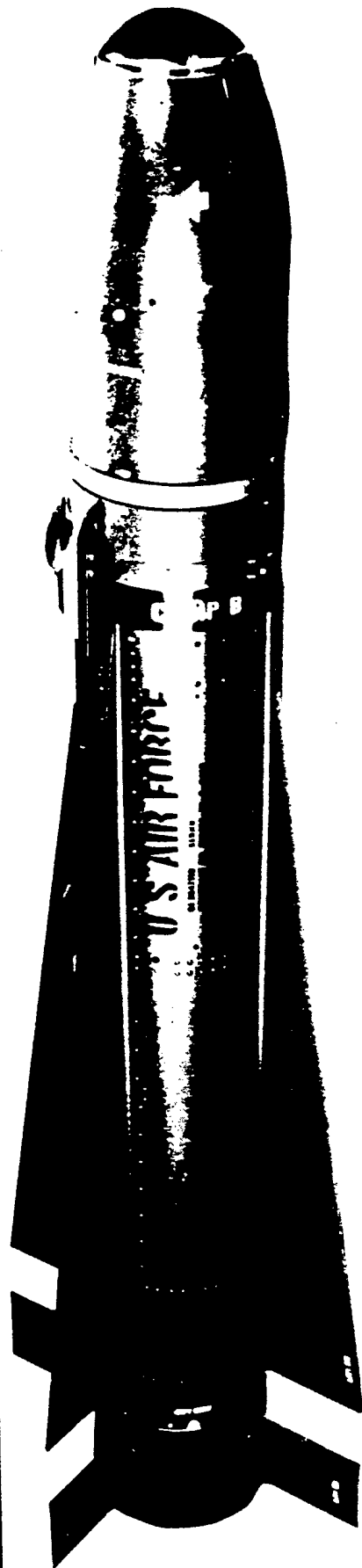
0.25 FT³
12 LB
80 W
SPACE
15 MIPS
SDI

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TWO GENERATIONS OF INFRARED IMAGING TECHNOLOGY



IR MAVERICK MISSILE

TOTAL WEIGHT 675 LBS
VOLUME 6.4 FT³

ELECTRONICS UNIT

WEIGHT 100 LBS
VOLUME 1.64 FT³
THROUGHPUT 4.0 MIPS

LEAP PROJECTILE

TOTAL WEIGHT 5.5 LBS
VOLUME 0.14 FT³

ELECTRONICS UNIT

WEIGHT 0.52 LBS
VOLUME 0.025 FT³
THROUGHPUT 4.2 MIPS

88UJ 3539
Nov 88

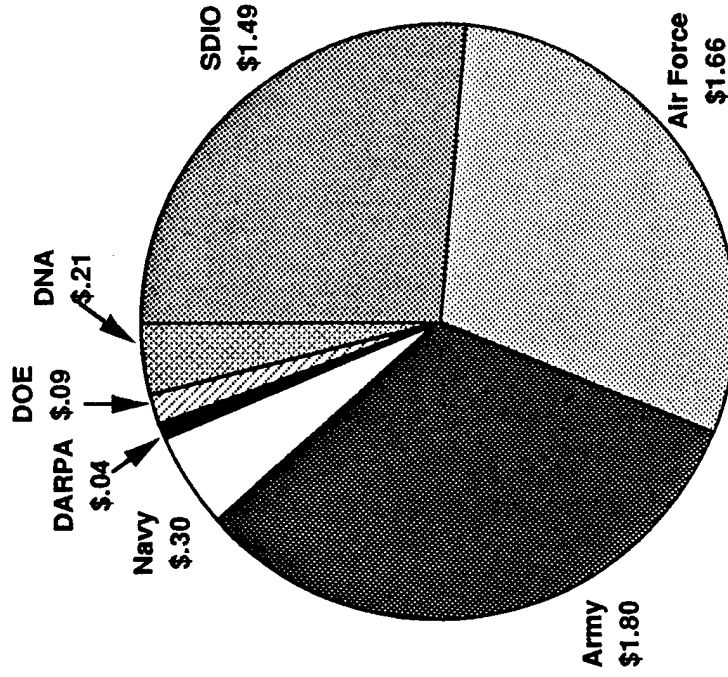
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FY 90-91 SDIO BUDGET

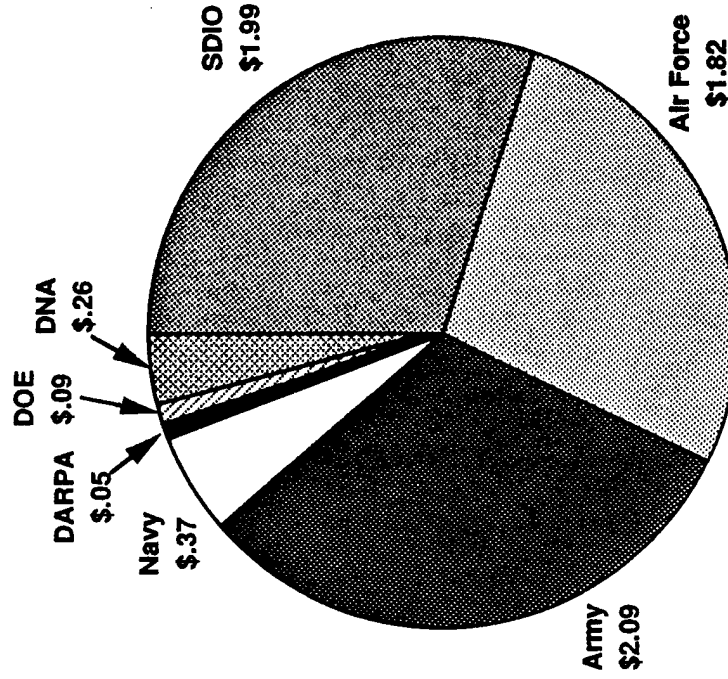
Executing Agents (\$ In Billions)

FY 90



Total: 5.59B

FY 91



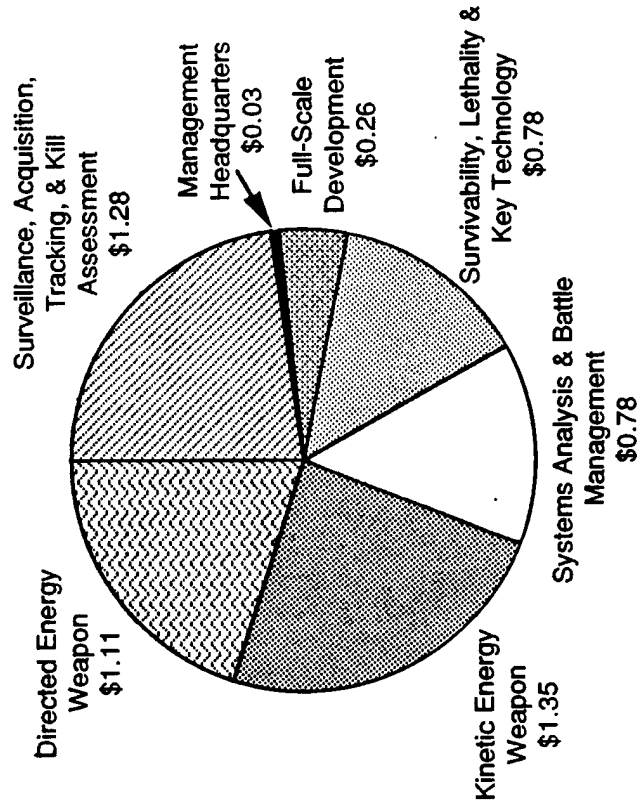
Total: 6.67B



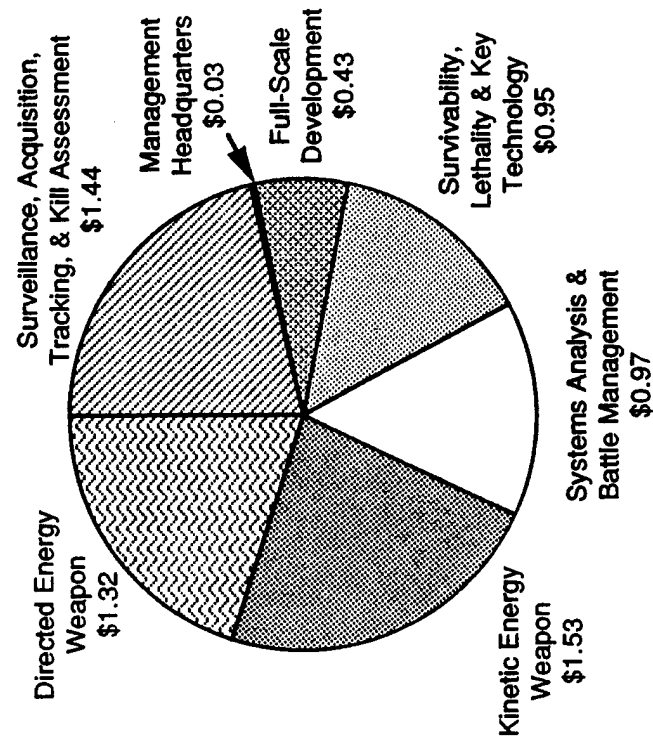
FY 90 - 91 SDIO BUDGET

Program Elements (\$ In Billions)

FY-90



FY-91





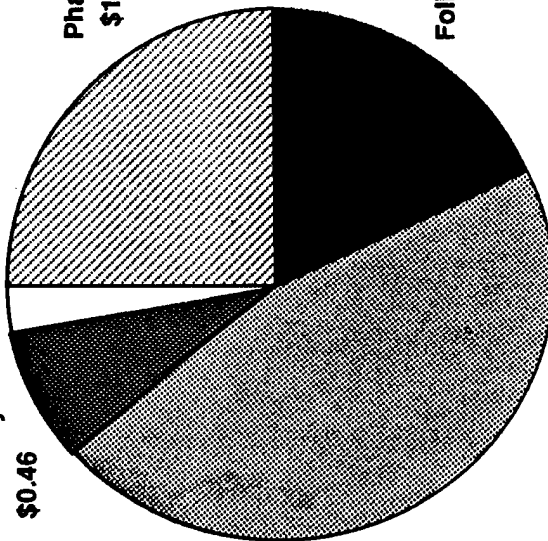
FY 90-91 SDIO BUDGET

Balanced Program (\$ In Billions)

FY 90

Management
\$0.17

Systems Analysis
\$0.46



Technology
\$2.60

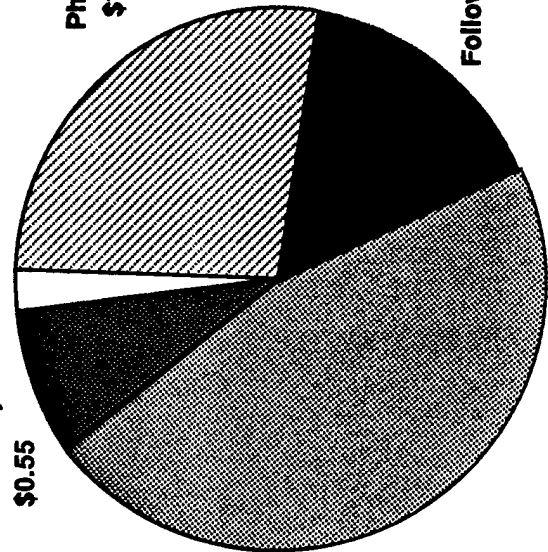
Follow-On System
\$1.04

Phase I
\$1.31

FY 91

Management
\$0.17

Systems Analysis
\$0.55



Technology
\$3.15

Follow-On System
\$1.12

Phase I
\$1.67



SUMMARY

- Substantial Investment
- Significant Technology Advances Focused By System Analysis
- Current Budget Maintains Balanced Program