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Mitigating a Threat

Pentagon announces plans to shoot down falling spy satellite

EDITOR's NOTE: On Feb. 14, 2008, Deputy National Security Advisor James Jeffrey, Vice Chairman, Joint Chiefs of Staff GEN James Cartwright and NASA Administrator Michael Griffin spoke at a press briefing regarding the U.S. decision to shoot down a falling U.S. spy satellite. Below is a portion of the transcript from that briefing. You can find the briefing in its entirety at http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=4145.

GEOFF MORRELL: As you know, for several weeks now this department and many others in the United States government have been closely monitoring a rapidly decaying U.S. intelligence satellite. Together we've been looking at options to mitigate any possible risks to human life as this — that could be caused with this satellite reentering the Earth's atmosphere.

Today we've assembled a group from across the government to come in here to explain the course of action that President Bush has selected. You'll hear first from Deputy National Security Adviser James Jeffrey; followed by the vice chairman of the Joint Chiefs, General "Hoss" Cartwright; and NASA Administrator Michael Griffin. Please allow them to finish their statements before chiming in with questions.

And with that, Ambassador Jeffrey?

JAMES JEFFREY: We first discussed the satellite publicly at the end of January after we had determined that it was coming down and as news reports began breaking. Following further decisions, we have decided to, of course, brief you today. We just finished briefing members and staff of both the House of Representatives and the Senate a little bit earlier today, and we're also doing a diplomatic roll-out across the world this afternoon.

What I'd like to do, is to sketch some of the background to the decision. Upon notification of the descending NRO (National Reconnaissance Office) satellite, the president and his national and homeland security advisers reviewed the options available to us to mitigate risk from the descending satellite. As background, I'd like to note that over the past 30-plus years there have been many satellites and other manmade objects falling from Space, of course. They have fallen with very little damage and no injuries.

What makes this case a little bit different, however, and in particular for the president in his consideration, was the likelihood that the satellite, upon descent to the Earth's surface, could release much of its thousand-plus pounds of hydrazine fuel as a toxic gas.

The likelihood of the satellite falling in a populated area is small, and the extent and duration of toxic hydrazine in the atmosphere would be quite limited; nevertheless, if the satellite did fall in a populated area, there was a possibility of death or injury to human beings beyond that associated with the fall of satellites and other Space objects normally, if we can use that word. Specifically, there was enough of a risk for the president to be quite concerned about human life.

Vice Chairman of the Joint Chiefs of Staff GEN James Cartwright, U.S. Marine Corps, talks about plans to destroy an unresponsive U.S. reconnaissance satellite with an interceptor missile during a Pentagon press briefing on Feb. 14, 2008. Cartwright was accompanied by Assistant to the President and Deputy National Security Advisor Ambassador James Jeffrey (left) and NASA Administrator Michael Griffin (not pictured). *Department of Defense photo by R. D. Ward*

And on that basis, he asked us to review our options

Apart from the normal consequence mitigation actions that we are prepared to deploy both at home and internationally to deal with the hydrazine, the one viable option we had, we concluded, was to use a tactical missile from an Aegis ship to strike the satellite in order to reduce the overall risk. This missile was designed, of course, for other missions, but we concluded that it could be reconfigured, both the missile and the various other systems related to it, on a one-time reversible basis to do the shot.

After further review of this option, and in particular consideration of the question of saving or reducing injury to human life, the president, on the recommendation of his national and homeland security teams, directed the Department of Defense to carry out the intercept.

Let me talk very briefly about the diplomatic side of this and then I'll turn it over to the vice chairman.

The United States has certain obligations based on treaties and other agreements related to activities in Space. The 1967 U.N. treaty on exploration and use of outer Space, in particular, calls on states to keep others informed of activities of potential concern.

While we do not believe that we meet the standard of Article IX of that treaty that says we would have to consult in the case of generating potentially harmful interference with other activities in Space, we do believe

The USS Lake Erie launches a Standard Missile-3 at a non-functioning National Reconnaissance Office satellite as it traveled in Space at more than 17,000 mph over the Pacific Ocean, Feb. 20, 2008. *Defense Department Photo Courtesy U.S. Navy*

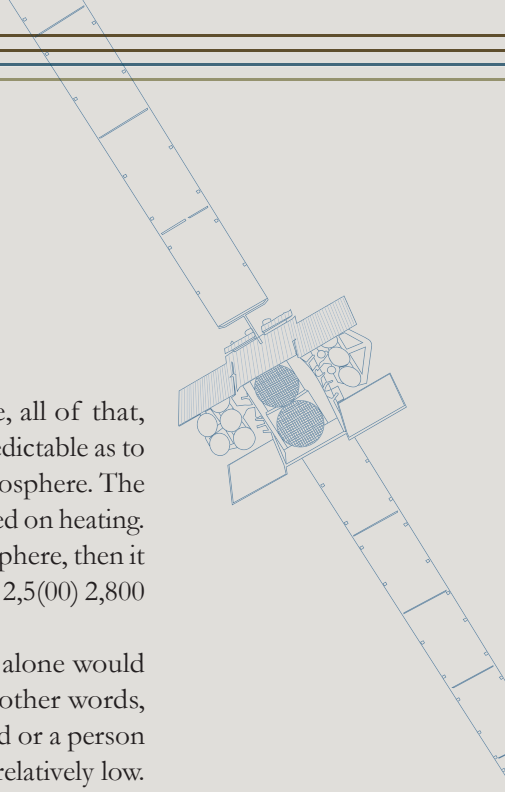
that it is important to keep other countries informed of what is happening.We let many countries know at the end of January that the satellite was descending, that it would likely have hydrazine, and talked a bit about the consequences of that. Today, we're reaching out to all countries and various organizations — the U.N., some of its subordinate agencies, the European Space Agency and NATO — to inform them of the actions that we're describing to you today.

GEN JAMES CARTWRIGHT: Just to re-baseline, this is a National Reconnaissance Office satellite. It was launched on 14 December, 2006 It's about roughly 5,000 pounds in its weight. Historically, a satellite of this size and that weight, roughly half of it would survive reentry.

We're saying in the modeling somewhere around 2,800 pounds would survive reentry. What is different here is the hydrazine. In this case, we do have some historical background that we can work against for the tank that contains the hydrazine And we had a similar tank on Columbia that survived reentry. So we have a pretty reasonable understanding that if the tank is left intact, it would survive the reentry.

This satellite essentially went dead for communications and control very shortly after it attained orbit. It was a nominal launch, a nominal insertion into orbit, but then, on orbit, within the first few hours stopped communicating.

A satellite like this — really, all of our satellites have fuel that is reserved, along with redundant systems, to ensure that there is propulsion to allow for what we would call a controlled de-orbit, but the ability to put it, say, in the ocean. But with no communication with this satellite, that's — that is what is different here. That's what distinguishes this particular activity, is we have no way to communicate to invoke the safety measures that are already onboard the bird.



To take it just a little bit further, hydrazine, in this case — normal case is that when it's used as rocket fuel, it's in a gaseous state. We bring it up to a liquid state with heaters This has had no benefit of heaters because there's no power on the bird. So this is a frozen state of hydrazine, which leaves for us another unknown: how much of it would melt on the reentry, therefore would be in either a liquid or gaseous phase.

In a worst-case scenario for the hydrazine, it's similar to chlorine or to ammonia in that when you inhale it, it affects your tissues in your lungs. You know it's — it has the burning sensation. If you stay very close to it and inhale a lot of it, it could in fact be deadly. But for the most part here, we're talking an area, say, roughly the size of two football fields that the hydrazine could be dispersed over, and you would at least incur something that would make you go to the doctor. If you stayed inside that zone, if you got very close to it and stayed, you could get to exposures that would be deadly.

So that's a sense of what we're dealing here with Columbia, and I'll let the administrator talk to that part of it but with Columbia, the hydrazine tank came down in Texas in a wooded area, unpopulated, and unlike this, we had the mitigating in front of it — they'd burned most of it. The mission was at its end. So it was almost no hydrazine left You could walk up very shortly after the event and walk right up to the tank's proximity and it wouldn't have affected you.

Now, we didn't handle it that way. We treated it as a toxic. Anybody who should encounter something like this ought to treat it as a toxic. Don't approach things like this.

Now, having said that, what we tried to do here at the department was to look at the risks that exist for what we call a normal reentry. This is normal for this satellite, not having the ability to deorbit it, it would basically enter the atmosphere. As I said, it would incur the heating. It may break up. And exactly what the pieces look like, all of that, we're not sure. It's very, very unpredictable as to exactly where it would hit the atmosphere. The atmosphere raises and lowers, based on heating. But when it encounters the atmosphere, then it would come down, as I said, about 2,5(00) 2,800 pounds' worth of mass

Those calculations and that alone would not be reason to take action. In other words, the likelihood of it hitting the land or a person as a hunk of metal or material is relatively low. It's the hydrazine here that is the distinguishing characteristic

I've also, like you, read the blogs. This is — there's some question about the classified side of this. That is really not an issue. Once you go through the atmosphere and the heating and the burning, that would not be an issue in this case. It would not justify using a missile to take it and break it up further.

Our objective here was to reduce the risk — could we reduce the risk to Space platforms, to airborne platforms, and to terrestrial platforms — the Earth, cities, people, etc.

In the first case, one of the first actions that we took together was we believe that the window that we were looking at to intercept this vehicle can be accomplished after we bring the Shuttle down.So we're going to bring the Shuttle down before we even consider this option.

The second is that we looked at the various capabilities that we as a nation hold, and what held the highest likelihood of success for us was to move to a mobile platform and a tactical weapon which we have good understanding of the performance of the weapon. That came to the standard missile — Navy missile that has been in the inventory for several years, has a very solid track record. We understand how to use it and how it works and what its likelihood of performance would be. In addition, it has a

mobile platform. And the intent in the mobile platform is, what we would like to be able to do, is to intercept this missile at a point at which we could have a high likelihood of bringing it down in an unpopulated area.

Second objective is to hit the tank, the hydrazine tank, and rupture it so that we can off-gas this hydrazine as early as possible so the least amount of it returns to the Earth, okay.

So those are the two key objectives. It is looking at the likelihood of mitigating on orbit, in the air or on the land.

On the orbit side, in Space, what we're attempting to do here is to intercept this just prior to it hitting the Earth's atmosphere. That does two things for us. It reduces the amount of debris that would be in Space — so in this case, what we're looking for it to try to have the debris, over 50 percent of it within the first two orbits or the first 10 or 15 hours would be deorbited. The second piece here is looking at other, unmanned bodies in Space, in low-Earth orbit, and the Space station to make sure that we did not increase the risk to other bodies in Space. So that was a criteria we're trying to understand.

Next is when the orbit comes down through the air, is there anything that would increase the risk to normal, general aviation. We have a set of standards — the FAA (Federal Aviation Administration) has a set of standards that it uses to re-vector aviation when there is a hazard in the air.

Would we cause a hazard in the air? If we did, would it be predictable enough that we could re-vector? That was a criteria we had to get through.

And then the last criteria was on earth, can we, in any way, help mitigate the opportunity for this to come on land, to land in a populated area?

And so we worked our way through those, and I'll let the director talk to the Space side of this equation. But suffice it to say, we believe that if we intercept this just prior to entry, and remember, this is not an aerodynamic body. If it were a ballistic missile and had aerodynamic properties, you could see it rising in one hemisphere and predict where it's going to come down in the next. And therefore that's how you'd accomplish an intercept.

A) This has no aerodynamic properties. Once it hits the atmosphere, it tumbles; it breaks apart; it is very unpredictable and next-to-impossible to engage. So what we're trying to do here is catch it just prior to the last minute, so it's absolutely (as) low as possible, outside the atmosphere, so that the debris comes down as quickly as possible. B) On the intercept, first, if we can hit the satellite, which we believe we have a high confidence we can do, that will slow the satellite down, which means it'll deorbit more quickly, and we can predict more accurately where it will deorbit, so we can potentially put it in a position in the ocean.

On the land side of the equation, again, objective would be to breach the tank and let the hydrazine escape. Second is to break apart the satellite, at least, so that the pieces can burn up on reentry a little easier, and we bring them down quicker. The last piece on land, we talked through a little bit, where we have an extensive program that we use regularly with deorbiting bodies, that notifies the world that we have something coming in, but this is highly unpredictable.

Again, they're not aerodynamic. So we can generally get a quadrant of the earth, you know, down to the last day. But it's down to the last one or two hours before we can tell you potentially a land mass, but not more accurately than that. So this is very difficult, because you have a very non-aerodynamic body trying to move through the air.

A couple of the other pieces here, to help put a little finer point on some of these. We're using the Standard Missile 3, well understood. It has the ability to get up just beyond the atmosphere, so it has the kinetic energy to be able to reach this satellite as it prepares to reenter.

We believe that the window for this activity will start here in the next three or four days. And we will be open for about maybe as many as seven or eight days.

Much of this depends on the heating of the atmosphere. So we're trying to build, knowing

Vice Chairman of the Joint Chiefs of Staff Marine GEN James Cartwright, left, and Deputy Defense Secretary Gordon England follow the progress of a Standard Missile-3 as it races toward a non-functioning National Reconnaissance Office satellite in Space over the Pacific Ocean, Feb. 20, 2008. *Defense Department Photo by U.S. Air Force Tech. Sgt. Adam M. Stump*

that, where would the best position be from the Earth to launch a missile to intercept that would drive this down into the ocean? And that's our objective, get rid of the hydrazine and have this fall in the ocean.

We'll use one missile with two back-ups. We'll have three ships on station, but it'll be one shot. The other missiles are there principally in case something in the launch phase does not work. We will have radars and Space sensors pointed at the area so that we have some sense of whether we were successful or not.

In the case that we're not successful with the first shot, we'll reassess, but two things will be working against us. One, the satellite will continue to progress across the Earth, and so, as it does, we'll only have a certain of amount of time before if we shot we'd have a higher likelihood of bringing it down on land, and we're not going to shoot if that's the case.

We have to be able to assess if parts of the satellite came apart is the — which part is which, and that's a very difficult thing to do. In other words, if the satellite grazed but did not directly impact, how do you decide whether you should take a second shot? And we'll work our way through that, but it'll be a conscious decision that we'll make.

We'll have a window, we believe probably might get as much as two days to make an assessment and come back before we really find it not feasible to reengage this target and to let it normally decay in its orbit. So it's a relatively small window. We'll take one shot and assess, and then we'll come back and look.

We feel confident that we will be able to assess, but this is not necessarily something that will occur in minutes. And that's the challenge, is to try to understand what it is we have after we've taken the shot, and what it'll take to come to the calculus that would say go ahead and reengage again, or reengagement will either increase the risk to Space, increase the risk to the air, or increase the risk on the ground. If either — any of those are the case, then we will not take a second shot.

At the end of this, just from my perspective, what to me was compelling as we reviewed the data is that if we fire at the satellite, the worst is that we miss, and then we have a known situation, which is where we are today.

If we graze the satellite, we're still better off because likely we'll still bring it down sooner and therefore more predictably. If

we hit the hydrazine tank, then we've improved our potential to mitigate that threat. So the regret factor of not acting clearly outweighed the regret factors of acting. And as long as that's the case, we felt that the responsible activity was to go ahead and try to engage the satellite.

MICHAEL GRIFFIN: My colleagues have said almost everything that would need to be said. I'll add a couple of quick remarks.

The first is that of course we've already alluded to the fact that we have a shuttle on orbit at the moment and a Space station on orbit permanently with a permanent crew, so we looked very carefully — from the first, NASA has been involved in this — we looked very carefully at increased risks to shuttle and station, and broadly speaking, they are negligible. They are at least a factor of 10 smaller than risks we take just being in Space anyway in the Shuttle. So they are not significant with respect to the risks we already assume to fly the Shuttle. On the Space station, of course, it's a different issue. The Space station is much more robust than the Shuttle. But even there the risk posture does not increase significantly. And so we are very comfortable that this is a decision made carefully and objectively and safely.

There are good times to conduct the intercept and poor times to conduct the intercept, based on the positioning of the station, and I and my colleagues will work together to make sure that, if possible, we pick one of the good times. But even the bad times are not too bad, and I would assure all of you that we've — we're conducting this with due regard to the safety of people on orbit.

I would make the point that — I would want to reinforce the point that GEN Cartwright made, is that there is a very large amount of uncertainty in predicting the landing zone of an entry object. It's generally acknowledged by specialists in the field that the best you'll do is to get within around 10 percent of the remaining lifetime of the bird, and that's the best

So, a month ahead of time, you will know when it will land within about three days. That, of course, allows the satellite to make multiple revolutions around the entire surface of the Earth So in essence, a month ahead of time, you have no idea. Ten days ahead of time, you'll be uncertain by at least a day.

Again, it will make 16 revolutions around the Earth in that day. It could land anywhere. On the day that you land, you will be uncertain by several hours. The satellite will make at least two orbits in that period of time, which again, sweeps out a very large fraction of the Earth

So it was necessary to make the decision about whether to engage days, weeks, even longer, if possible, ahead of when it will actually land, because it is simply not possible to predict whether it will land in the middle of the Pacific or in a populated area. The decision had to be made before we could be certain where it would go.

I would also — to again emphasize General Cartwright's point that almost anything that we can do with this turns out to be either neutral or better. Neutral is if we miss. Nothing changes. If we shoot and barely touch it, the satellite is at this point just barely in orbit. Almost anything that you do to it when it is just barely in orbit is going to cause it to reenter within the next couple of orbits. And of course, if we shoot and get a direct hit then that's a clean kill and we're in good shape.

So there is almost nothing we can do here that makes it worse. Almost everything we can do, technically, makes it better, which was a very strong factor weighting the decision. With that, I will close. I don't think we need anything more.

The USS Lake Erie launches a Standard Missile-3 at a non-functioning National Reconnaissance Office satellite as it traveled in Space at more than 17,000 mph over the Pacific Ocean, Feb. 20, 2008. The objective was to rupture the satellite's fuel tank to dissipate the approximately 1,000 pounds of hydrazine, a hazardous material which could pose a danger to people on Earth, before it entered into the Earth's atmosphere. *Defense Department photo courtesy U.S. Navy*